Attachment A: Flow Frequency Memorandum

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office
4949-A Cox Road Glen Allen, Virginia 23060

SUBJECT: Flow Frequency Determination / 303(d) Status
HRSD Central Middlesex STP – VA0073318

TO: Laura Galli

FROM: Jennifer Palmore, P.G.

DATE: July 13, 2015

COPIES: File

The HRSD Central Middlesex Sewage Treatment Plant (STP) discharges to an unnamed tributary of Urbanna Creek near Saluda. The outfall is located at rivermile 3-XCM000.80. Flow frequencies have been requested for use in developing effluent limitations for the VPDES permit.

On the USGS 7.5' Saluda Quadrangle topographic map, the facility discharges to an ephemeral ditch which drains to an intermittent stream. The flow frequencies for dry ditches and intermittent streams are listed below.

Unnamed tributary at Outfall 001:

1Q30 = 0.0 cfs	High Flow 1Q10 = 0.0 cfs
1Q10 = 0.0 cfs	High Flow 7Q10 = 0.0 cfs
7Q10 = 0.0 cfs	High Flow 30Q10 = 0.0 cfs
30Q10 = 0.0 cfs	HM = 0.0 cfs
30Q5 = 0.0 cfs	

During the draft 2014 305(b)/303(d) Integrated Water Quality Assessment Report, the receiving stream was not assessed for any designated use; therefore, it is considered a Category 3A waterbody.

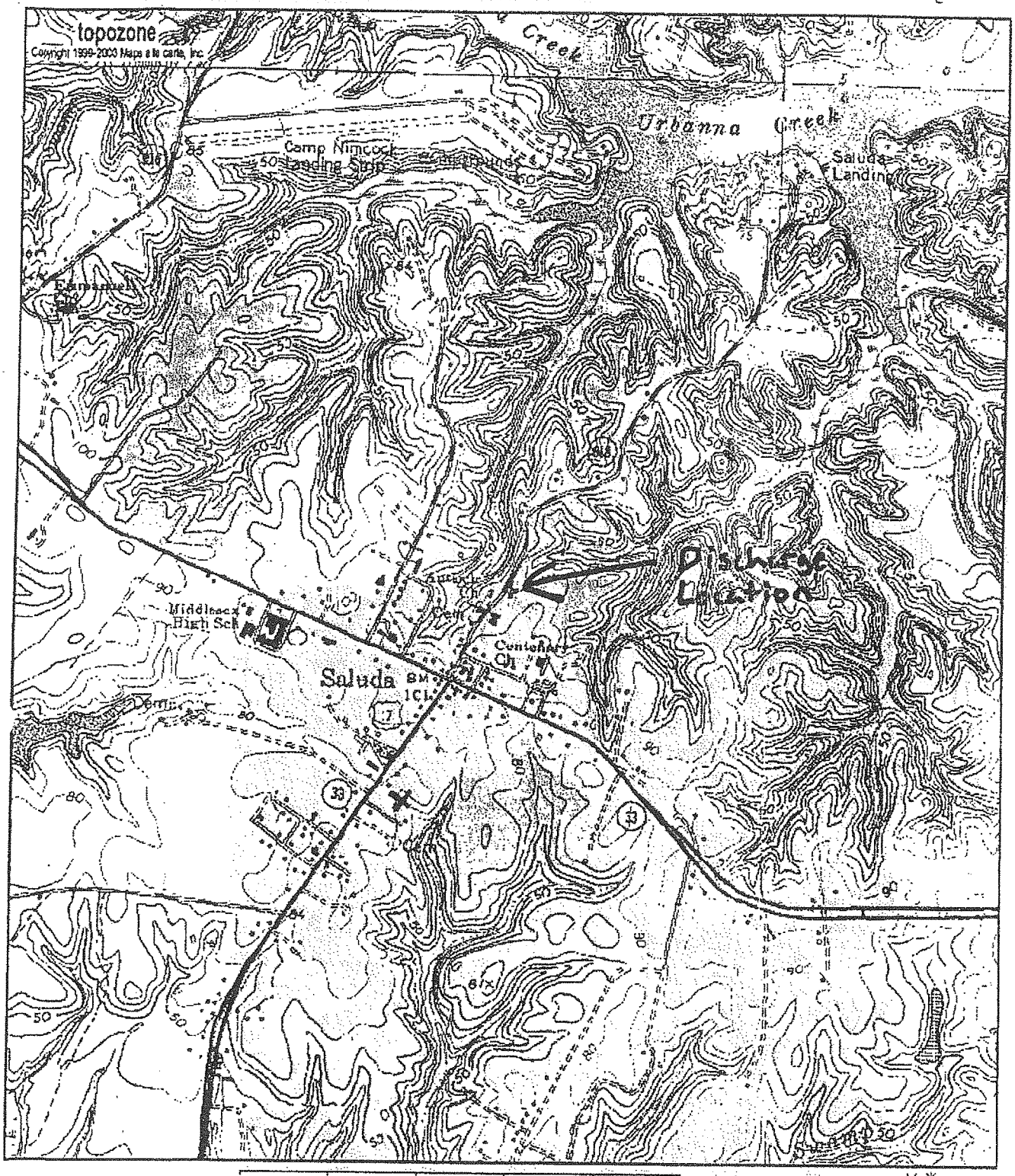
Due to its ephemeral nature, the tributary is considered a Tier 1 water. Effluent data should be used to characterize the stream at low-flow conditions.

The Urbanna Creek Shellfish Bacterial TMDL was approved by the EPA on 11/15/2005 and the SWCB on 9/27/2006. Although the facility is located within the TMDL study area, it was not addressed in the TMDL because the discharge drains to a prohibited zone where the shellfish use is considered removed.

HRSD Central Middlesex was also addressed in the Chesapeake Bay TMDL, which was approved by the EPA on 12/29/2010. The TMDL allocates loads for total nitrogen, total phosphorus, and total suspended solids to protect the dissolved oxygen and SAV criteria in the Chesapeake Bay and its tidal tributaries. The discharge was included in the aggregated loads for non-significant wastewater dischargers in the Rappahannock River mesohaline estuary (RPPMH). The nutrient allocations are administered through the Watershed Nutrient General Permit; the TSS allocations are considered aggregated and facilities with technology-based TSS limits are considered to be in conformance with the TMDL.

If you have any questions concerning this analysis or need additional information, please let me know.

Attachment B: Site Maps and Facility Diagram



0 0.3 0.6 0.9 1.2 1.5 km

0 0.2 0.4 0.6 0.8 1 mi

37° 36' 33"N, 76° 35' 35"W (NAD83/WGS84)

Antioch Church, USGS Saluda (VA) Quadrangle

Projection is UTM Zone 18 NAD83 Datum

M=-10.767

G=-0.973

OWNER'S CONSENT:

THE SUBDIVISION OF PROPERTY, AS IT APPEARS ON THIS PLAT, IS WITH THE FREE CONSENT AND IN ACCORDANCE WITH THE DESIRES OF THE UNDERSIGNED OWNER(S), PROPRIETORS AND TRUSTEES, IF ANY.

MIDDLE PENINSULA REGIONAL JAIL AUTHORITY — DATE
FRANK A. PLEVA (CHAIRMAN)

COMMONWEALTH OF VIRGINIA
COUNTY OF _____, TO-WIT:
THE FOREGOING INSTRUMENT WAS ACKNOWLEDGED BEFORE ME THIS _____ DAY OF _____, 2010.

NOTARY PUBLIC

MY COMMISSION EXPIRES: _____

GENERAL NOTES:

1. THIS PLAT WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND DOES NOT NECESSARILY SHOW ALL EASEMENTS, SERVITUDES AND COVENANTS OF RECORD..
2. THE LAND DELINEATED HEREON IS LOCATED ON COUNTY TAX MAP NO. 26B(1) AS PARCEL 86C (IN PART).
3. CURRENT OWNER & REFERENCES:
   MIDDLE PENINSULA REGIONAL JAIL AUTHORITY
   D.B. 251 @ PG. 693; D.B. 132 @ PG. 634 (PLAT AT PG. 639);
4. THIS PARCEL LIES IN ZONE X, AREA DETERMINED TO BE OUTSIDE THE FLOOD HAZARD AREA, AS DEFINED ON THE NATIONAL FLOOD INSURANCE RATE MAP PANEL NO. 51009B 0050 B, DATED JANUARY 18, 1989.
5. SITE IS ZONED: GB (GENERAL BUSINESS)
6. THERE ARE NO RESOURCE PROTECTIONA AREAS ON THIS SITE.
7. PERIMETER BOUNDARY OF PARCEL 86C SHOWN HEREON TAKEN FROM PLAT IN D.B. 132 @ PG. 639.

CERTIFICATE OF CERTIFIED LAND SURVEYOR:

THE SUBDIVISION OF LAND AS SHOWN ON THIS PLAT, CONTAINING 7.978 ACRES, SITUATED IN THE SALUDA MAGISTERIAL DISTRICT, IN THE COUNTY OF MIDDLESEX, VIRGINIA, HAVING BEEN CONVEYED TO MIDDLE PENINSULA REGIONAL JAIL AUTHORITY BY DEED DATED JANUARY 30, 1996 AND OF RECORD IN THE CLERK'S OFFICE OF THE CIRCUIT COURT OF MIDDLESEX COUNTY, VIRGINIA IN DEED BOOK 251 @ PG. 693.

I, THE UNDERSIGNED HEREBY CERTIFY THAT THIS PLAT IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND IS BASED ON A CURRENT FIELD SURVEY.

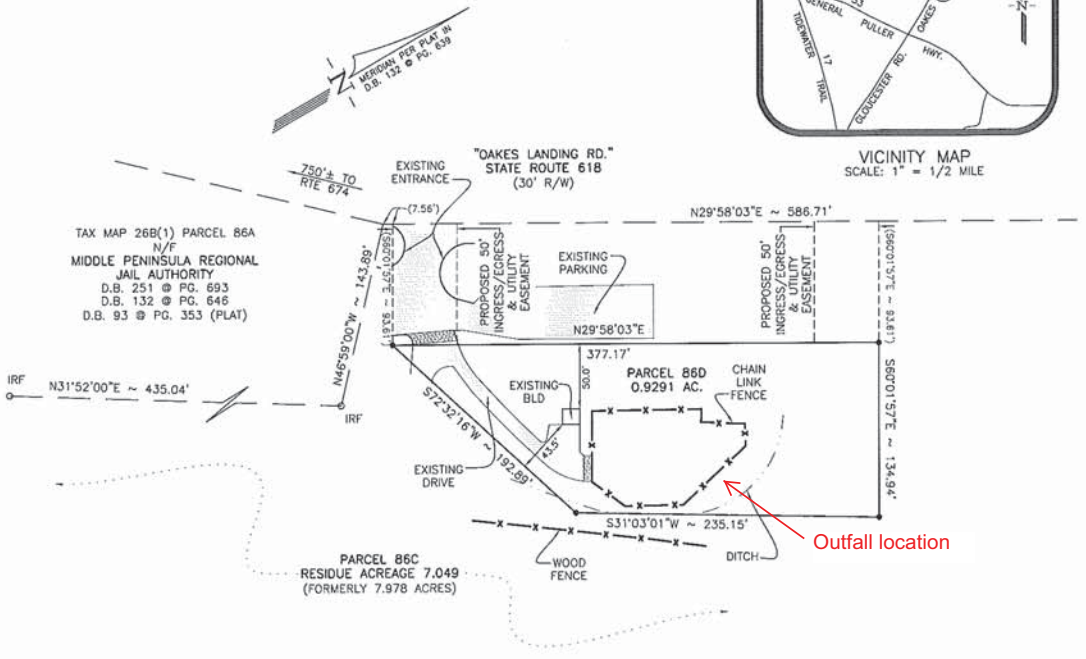
COMMONWEALTH OF VIRGINIA
04/26/2010
GORDON L. JONES
Lic. No. 1774
LAND SURVEYOR

CERTIFICATE OF APPROVAL:

THIS PLAT IS APPROVED BY THE UNDERSIGNED IN ACCORDANCE WITH EXISTING SUBDIVISION REGULATIONS, INCLUDING THE MIDDLESEX COUNTY SUBDIVISION AND ZONING ORDINANCES, AND MAY BE COMMITTED TO RECORD.

DATE — SUBDIVISION AGENT OF MIDDLESEX COUNTY, VIRGINIA

VICINITY MAP
SCALE: 1" = 1/2 MILE



TAX MAP 26B(1) PARCEL 70
N/F
TRI-COUNTY VAULT COMPANY, INC.
D.B. 245 @ PG. 625
P.B. 12 @ PG. 268

TAX MAP 26 PARCEL 108
N/F
MIDDLE PENINSULA REGIONAL JAIL AUTHORITY
D.B. 320 @ PG. 494
P.B. 15 @ PG. 180
P.B. 7 @ PG. 31

LEGEND:

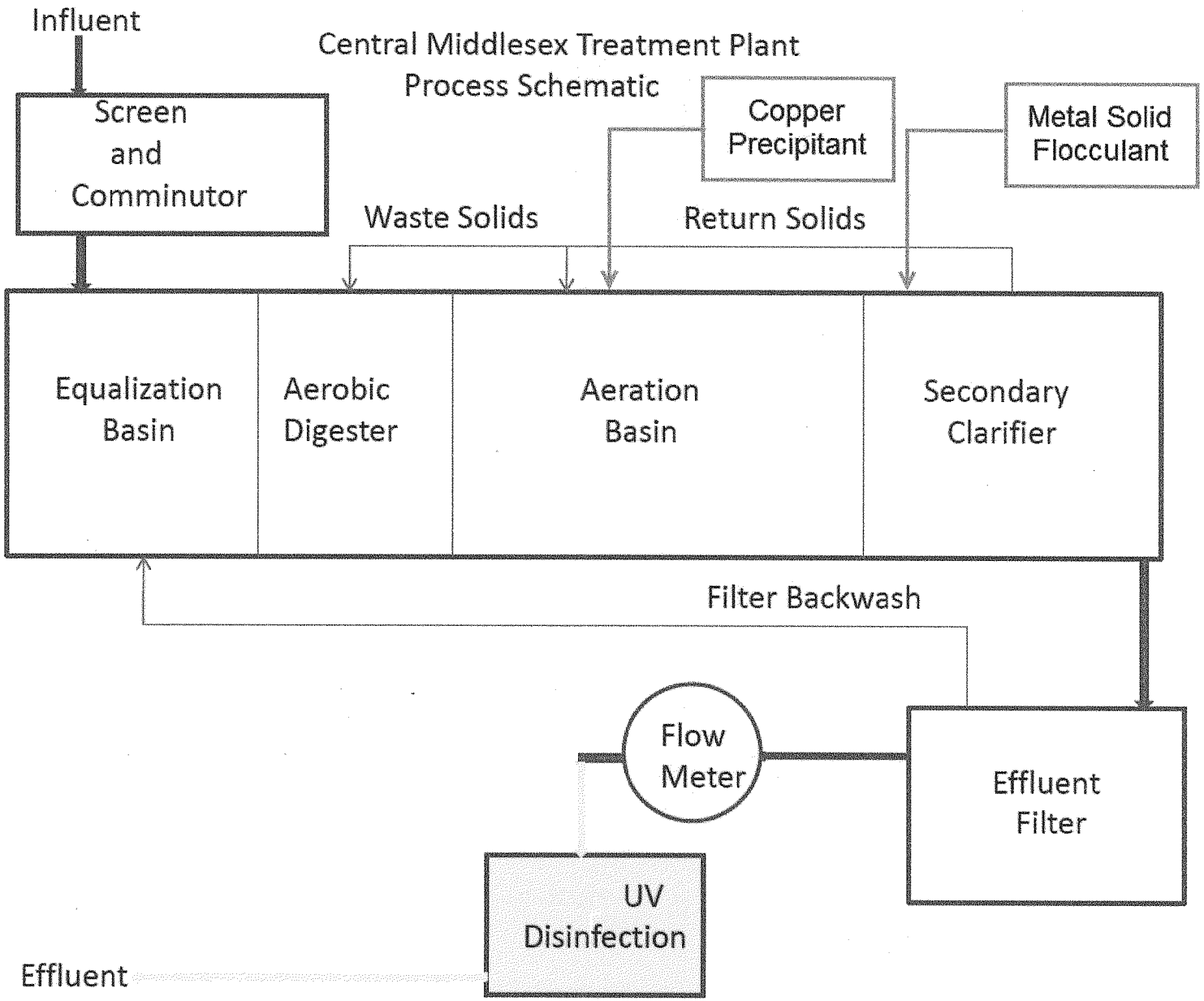
- IRON ROD FOUND (IRF) OR IRON PIPE FOUND (IPF)
- T-BAR FOUND (TBF)
- CONCRETE MONUMENT FOUND
- IRON ROD OR PIPE SET
- CONCRETE MONUMENT SET
- POWER POLE
- N/F NOW OR FORMERLY
- R/W RIGHT-OF-WAY

PLAT

SHOWING DIVISION OF THE LAND OF
MIDDLE PENINSULA REGIONAL JAIL AUTHORITY
PARCEL 86D BEING THE LAND TO BE CONVEYED TO
HAMPTON ROADS SANITATION DISTRICT
LOCATED IN THE SALUDA DISTRICT OF
MIDDLESEX COUNTY, VIRGINIA
SCALE: 1"= 60' DATE: APRIL 26, 2010

COMP: HDB/GLJ	
CAD: HDB	
CHECKED: GLJ	
JN: 97224-02	
FILED: 97224SUB	

RICHMOND
8550 MEE CREEK ROAD
MECHANICSVILLE, VIRGINIA 23116
804-559-7050 (F) 804-559-7051
MIDDLE PENINSULA
5920 Palmyra Drive
GLOUCESTER, VIRGINIA 23061
804-693-2393 (F) 804-693-5595
NORTHERN NECK
612 Rappahannock Drive
WHITE STONE, VIRGINIA 22578
804-435-8425 (F) 804-435-8427
www.baydesigngroup.com
BAY design group
Engineering Surveying & Land Planning


Influent
Central Middlesex Treatment Plant
Process Schematic
Screen
and
Comminutor
Copper
Precipitant
Metal Solid
Flocculant
Waste Solids
Return Solids
Equalization
Basin
Aerobic
Digester
Aeration
Basin
Secondary
Clarifier
Filter Backwash
Flow
Meter
Effluent
Filter
UV
Disinfection
Effluent

Attachment C: Site Visit and Site Inspection Reports

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office

4949-A Cox Road, Glen Allen, VA 23060-6296 **804/527-5020**

MEMORANDUM

To: File

From: Laura Galli, VPDES Permit Writer
Piedmont Regional Office

Subject: Permit Revocation and Reissuance Site Visit
VA0073318 Central Middlesex STP

Date: September 11, 2015

On September 11, 2015, I visited the Central Middlesex STP as part of the Permit revocation and reissuance process. Lauren Grimmer, Jeff Sparks and Paul Haas of HRSD met with me on site. The plant treats domestic wastewater from the jail and courthouse complex. The plant is equipped with a manual bar screen for large debris removal, and a comminutor (Figure 1). If the pipe from the screen to the comminutor becomes blocked, the wastewater can bypass the comminutor and discharge directly to the equalization tank (Figure 2). From this unit the water is pumped to a splitter box, and subsequently to the aeration basin (Figure 2). Air is provided continuously to the aeration tank by two blowers; the dissolved oxygen is usually between 2 to 3 mg/L. No foam was observed in the aeration basin. This basin is also equipped with a precipitant drip feeding for metals removal. The secondary clarifier has two chambers operated in parallel; some solids/grit were present, but no discernible odor (Figure 3). Water from the clarifier is then directed through sand filters; after filtration, water is then pumped to a clear water well, and eventually to the UV system. The UV system has three bulb assemblies, with two bulbs for each assembly (Figure 4). Routine cleaning of the bulbs is performed weekly, while replacement of the bulbs is done annually. The disinfected water is then directed to the post aeration tank. The samples are collected prior to the discharge of the effluent at outfall 001 (Figure 5). The outfall was observed at the dry ditch (Figure 6) right outside the plant's fence line; minimal discharge was occurring during the visit. The plant appeared in very good operational conditions.

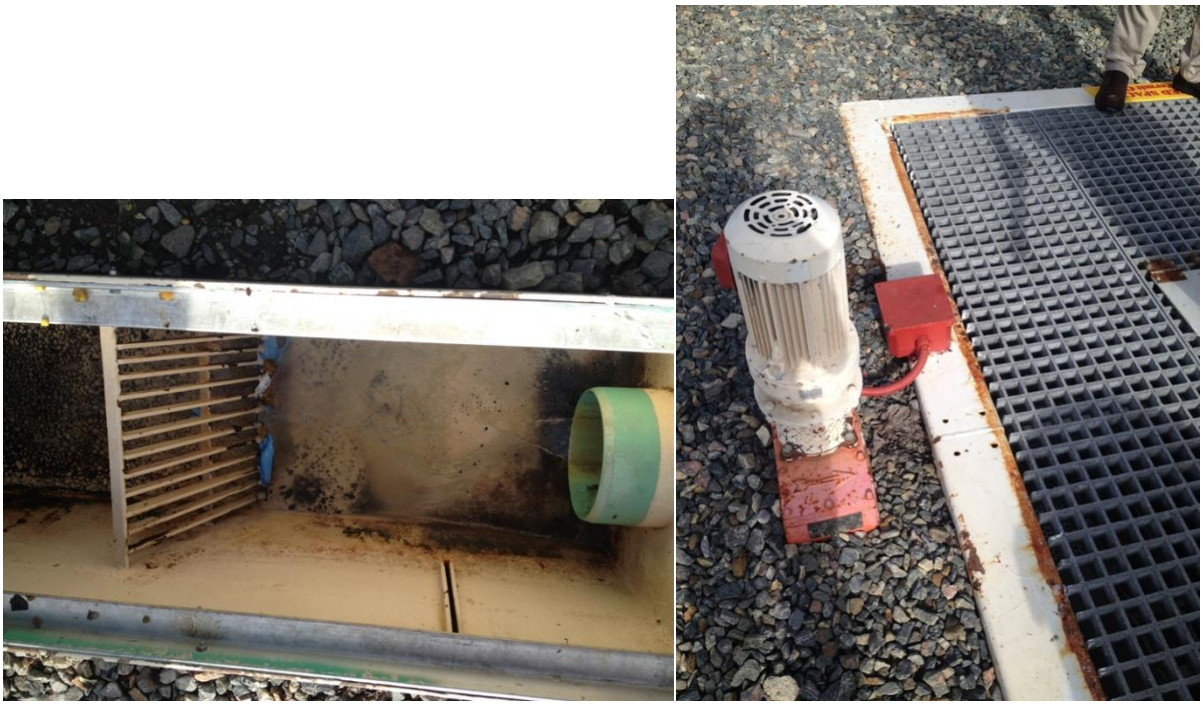


Figure 1: Bar Screen and Comminutor

Figure 2: Equalization tank (background) and Aeration Basin

Figure 3: Secondary Clarifier (showing solids)

Figure 4: UV System

Figure 5: Sampling Location

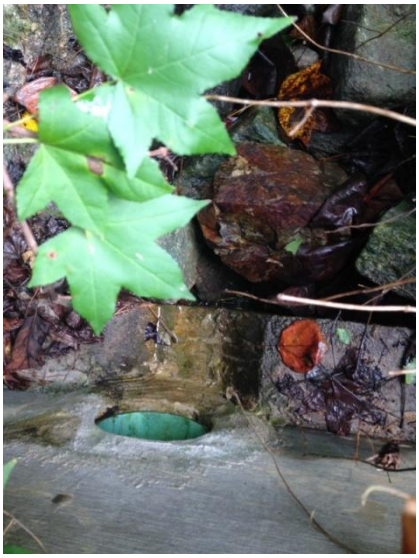


Figure 6: Outfall 001

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
PIEDMONT REGIONAL OFFICE
4949-A Cox Road, Glen Allen, Virginia 23060
(804) 527-5020 Fax (804) 527-5106
www.deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

Michael P. Murphy
Regional Director

February 4, 2013

Ms. Sharon J. Nicklas
HRSD
P.O. Box 5911
Virginia Beach, VA 23471-0911

RE: VPDES Inspections- HRSD-Urbanna WWTP (Permit No. VA0026263/VAN020034) and HRSD-Central Middlesex STP (Permit No. VA0073318) – Inspection Reports

Dear Ms. Nicklas:

Enclosed are copies of the inspection reports (including technical and laboratory reviews) from the inspections performed at the above referenced facilities on January 9, 2013. The plants appeared to be in good condition and capable of producing a good quality effluent. Please read the enclosed reports for details concerning the inspection. No compliance recommendations were noted during the inspection; therefore, no response to this correspondence is required.

I would like to thank Mr. Zack Crowell and the WWTP Operators at each plant for the time and courtesy extended to us during the inspection. If you have any questions or comments regarding the inspections, please feel free to contact me at (804) 527-5017 or Heather Deihls at (804) 527-5064.

Sincerely,

Meredith R. Williams
Environmental Inspector

Enclosures

Virginia Department of Environmental Quality

WASTEWATER FACILITY INSPECTION REPORT

FACILITY NAME: Central Middlesex STP		**INSPECTION DATE:**	January 9, 2013
		INSPECTOR	Heather Deihls and Meredith Williams 1-17-13
PERMIT No.: VA0073318		**REPORT DATE:**	January 17, 2013
TYPE OF FACILITY: ☑ Municipal ☑ Small Minor ☐ Industrial ☐ Federal		**TIME OF INSPECTION:**	0902 Arrival / 0958 Departure
		TOTAL TIME SPENT (including prep & travel)	8 hours
PHOTOGRAPHS: ☑ Yes ☐ No		**UNANNOUNCED INSPECTION?**	☐ Yes ☑ No
REVIEWED BY / Date: MEW 1/22/13 KLW 1/25/13			
PRESENT DURING INSPECTION: Zack Crowell, Class I operator; Brandon Wood, O.I.T; Sam Henderson, O.I.T.			

TECHNICAL INSPECTION

1. Has there been any new construction? • If so, were plans and specifications approved? Comments: UV disinfection installed and CTO issued.	☑ Yes ☐ No
2. Is the Operations and Maintenance Manual approved and up-to-date? Comments: Approved 3/16/12.	☑ Yes ☐ No
3. Are the Permit and/or Operation and Maintenance Manual specified licensed operator being met? Comments: Class IV required.	☑ Yes ☐ No
4. Are the Permit and/or Operation and Maintenance Manual specified operator staffing requirements being met? Comments: The plant is adequately staffed with 2 operators (shifts vary), 8 hours per day, 7 days per week.	☑ Yes ☐ No
5. Is there an established and adequate program for training personnel? Comments:	☑ Yes ☐ No
6. Are preventive maintenance task schedules being met? Comments: Tasks issued electronically via CMMS sytem.	☑ Yes ☐ No
7. Does the plant experience any organic or hydraulic overloading? Comments:	☐ Yes ☑ No
8. Has there been any bypassing or overflows since the last inspection? Comments:	☐ Yes ☑ No
9. Is the standby generator (including power transfer switch) operational and exercised regularly? Comments: Exercised weekly; under full load for one hour.	☑ Yes ☐ No
10. Is the plant alarm system operational and tested regularly? Comments: Visually checked daily; autonotification system is tested automatically three times daily.	☑ Yes ☐ No

VA DEQ Wastewater Facility Inspection Report

Permit #	VA0073318

TECHNICAL INSPECTION

11. Is sludge disposed of in accordance with the approved sludge management plan? Comments: Waste sludge is pumped and hauled by a septic truck to the HRSD West Point plant as needed.	☑ Yes ☐ No
12. Is septage received? • If so, is septage loading controlled, and are appropriate records maintained? Comments:	☐ Yes ☑ No
13. Are all plant records (operational logs, equipment maintenance, industrial waste contributors, sampling and testing) available for review and are records adequate? Comments:	☑ Yes ☐ No

14. Which of the following records does the plant maintain?

☑ Operational logs ☑ Instrument maintenance & calibration

☑ Mechanical equipment maintenance ☐ Industrial Waste Contribution (Municipal facilities)

Comments:

15. What does the operational log contain?

☑ Visual observations ☑ Flow Measurement ☑ Laboratory results ☑ Process adjustments

☑ Control calculations ☐ Other (specify)

Comments:

16. What do the mechanical equipment records contain?

☑ As built plans and specs ☑ Manufacturers instructions ☑ Lubrication schedules

☑ Spare parts inventory ☑ Equipment/parts suppliers

☐ Other (specify)

Comments:

17. What do the industrial waste contribution records contain (Municipal only)?

☐ Waste characteristics ☐ Impact on plant ☐ Locations and discharge types

☐ Other (specify)

Comments: N/A

18. Which of the following records are kept at the plant and available to personnel?

☑ Equipment maintenance records ☑ Operational log ☐ Industrial contributor records

☑ Instrumentation records ☑ Sampling and testing records

Comments:

19. List records not normally available to plant personnel and their location:
Comments: Training records, spare pumps, UV bulbs, blower air filters, paper records are all maintained at the HRSD- West Point plant.

20. Are the records maintained for the required time period (three or five years)? Comments:	☑ Yes ☐ No

21. Are back flow prevention devices present? Yes, need to be verified. See "Notes and Comments" section on page 5.

VA DEQ Wastewater Facility Inspection Report

Permit #	VA0073318

UNIT PROCESS EVALUATION SUMMARY SHEET

UNIT PROCESS	APPLICABLE	PROBLEMS*	COMMENTS
Sewage Pumping			
Flow Measurement (Influent)			
Screening/Comminution	X		
Grit Removal			
Oil/Water Separator			
Flow Equalization	X		
Ponds/Lagoons			
Imhoff Tank			
Primary Sedimentation			
Trickling Filter			
Septic Tank and Sand Filter			
Rotating Biological Contactor			
Activated Sludge Aeration	X		
Biological Nutrient Removal			
Sequencing Batch Reactor			
Secondary Sedimentation	X		
Flocculation			
Tertiary Sedimentation			
Filtration	X		
Micro-Screening			
Activated Carbon Adsorption			
Chlorination			
Dechlorination			
Ozonation			
Ultraviolet Disinfection	X		
Post Aeration	X		
Flow Measurement (Effluent)	X	3	*Details on page 4.*
Land Application (Effluent)			
Plant Outfall	X		
Aerated Sludge Holding Tank			
Flotation Thickening (DAF)			
Gravity Thickening			
Aerobic Digestion	X		
Anaerobic Digestion			
Lime Stabilization			
Centrifugation			
Sludge Press			
Vacuum Filtration			
Drying Beds			
Thermal Treatment			
Incineration			
Composting			
Land Application (Sludge)			

* Problem Codes

1. Unit Needs Attention
2. Abnormal Influent/Effluent
3. Evidence of Equipment Failure
4. Unapproved Modification or Temporary Repair
5. Evidence of Process Upset
6. Other (explain in comments)

VA DEQ Wastewater Facility Inspection Report

Permit #	VA0073318

INSPECTION OVERVIEW AND CONDITION OF TREATMENT UNITS

Bar Screen – The bar screen is adequate to collect large debris. It is manually cleaned as needed. Operators place debris in a covered 55-gallon can. The operator stated lime is added to screenings and sent to the landfill. If the pipe from the screen to the comminutor becomes blocked, the wastewater can bypass the comminutor and discharge directly to the surge tank. The bypass has not been used since HRSD took over operations. There was very low flow entering and moving through the plant at the time of this inspection.

Comminutor – This unit follows the bar screen and has a basket screen afterwards to catch any debris that passes through the screen and comminutor. The basket screen is dumped as needed approximately every three days. The comminutor was replaced in 2012.

Aerated Equalization (Surge) Tank – Two pumps are operated in lead/lag mode – the second pump turns on when the water level reaches a certain height. The tank is equipped with an alarm to signal high level, pump and power failure. All alarms in the plant report to an automated remote alarm system. At the time of inspection, the facility was drip feeding a precipitant (Jenfitch JC9830) at a rate of 18 lbs/day for metals removal.

Splitter Box – Water is pumped from the equalization tank to the aboveground splitter box. This box is valved to keep flow even to aeration and can be set to return water to the equalization tank.

Aeration Tank – Blowers provide air continuously to this basin. If dissolved oxygen levels are low, a second blower is manually turned on. The 30-minute settleability was 410 the day of inspection and the dissolved oxygen is typically about 2.0 mg/L. The operator typically wastes based on MLSS in the return. The aeration diffusers are replaced about once per year. Minor, light foam was noted and aeration appeared adequate.

Blowers (5) – Five blowers are maintained and provide air to the EQ tank, aeration tank, sand filter and post aeration. Blowers are all interchangeable and manually alternated weekly.

Clarifier – The secondary clarifier has two chambers operated in parallel. Good settling was observed in the clarifier; some floating solids/grit were present. Two skimmers in the clarifier return to the head of the plant. There were no discernible odors. At the time of inspection, there was no discharge from the clarifier due to low flow. The facility drip feeds polymer (Jenfitch JC1687) for metals removal at a rate of 18 lbs/day. The walls of the clarifier are brushed and the surface is manually skimmed daily.

Aerated Sludge Digester – The facility typically wastes 4 minutes/day resulting in ~300-400 gallons. Once the holding tank becomes full, a septic truck pumps and hauls to the HRSD- West Point WWTP. In order to not re-introduce settled metals back to the plant, the facility is currently not decanting water from the digester. This results in pumping and hauling on a weekly basis.

Filtration – Water from the clarifier enters a chamber where it passes through two sand filters. High water levels trigger the backwash cycle. Treated wastewater is used for backwashing. Filter backwash is pumped back to a mudwell before being pumped to the surge tank. Media in the filter is routinely replaced on an annual basis. Media was replaced in the fall of 2012.

Clear Well – After filtration, water is pumped to a clear water well. A float activated system pumps water to the UV system.

UV Disinfection - One UV unit is present with 3 assemblies each (2 bulbs each assembly). The facility maintains records of lamp operating hours and bulb replacement dates. Routine cleaning occurs weekly. Spare bulbs and units are maintained onsite. Final effluent from the UV system appeared clear.

Post Aeration – Blowers provide constant air. Standing water in this well was very clear and turbulent.

Sample Collection - Samples are collected in the former chlorination chamber.

Flow Measurement – The parshall flume is equipped with an ultra-sonic meter with totalizer calibrated on 10/24/12. The flow meter is calibrated quarterly. Inspectors noted that although there appeared to be little to no flow, the meter was reading 0.4 gallons/minute. The facility contact stated they would look into this anomaly.

Outfall – The shore based outfall discharges onto rip-rap and appeared to be in good condition. The discharge is to a dry ditch visible just outside of the facility fence line. The receiving stream is not visible from the facility. There was no discharge at the time of inspection.

VA DEQ Wastewater Facility Inspection Report

Permit #	VA0073318

EFFLUENT FIELD DATA: None.

Flow	MGD	**Dissolved Oxygen**	mg/L	**TRC (Contact Tank)**	mg/L
pH	S.U.	**Temperature**	°C	**TRC (Final Effluent)**	mg/L

Was a Sampling Inspection conducted? ☐ Yes (see Sampling Inspection Report) ☑ No

CONDITION OF OUTFALL AND EFFLUENT CHARACTERISTICS:

1. Type of outfall:
   ☑ Shore based ☐ Submerged
2. Diffuser?
   ☐ Yes ☑ No
3. Are the outfall and supporting structures in good condition?
   ☑ Yes ☐ No
4. Final Effluent (evidence of following problems): **NONE.**
   ☐ Sludge bar ☐ Grease ☐ Turbid effluent ☐ Visible foam ☐ Unusual color ☐ Oil sheen
5. Is there a visible effluent plume in the receiving stream?
   ☐ Yes ☑ No
6. Receiving stream:
   ☑ No observed problems
   ☐ Indication of problems (explain below)

   Comments: Receiving stream is not visible at the plant. Effluent appeared clear and no discernible environmental impacts were observed in the discharge ditch.

REQUIRED CORRECTIVE ACTIONS:

1. None.

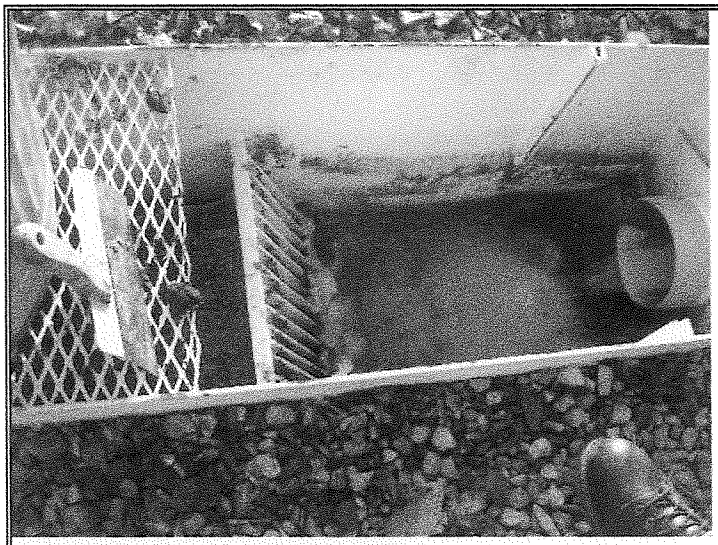
NOTES and COMMENTS:

1. As a reminder, please investigate the cause of the flow meter reading 0.4 gallons/minute when there was visibly less (if not zero) flow. Follow-up as necessary with repairs or calibrations.
2. As a reminder, the backflow prevention device must be tested annually. Please test this equipment as soon as possible.

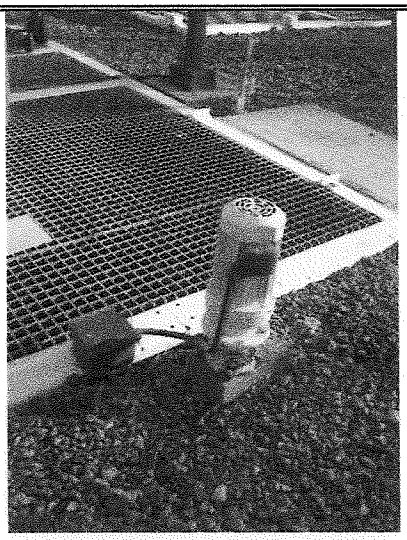
VA DEQ Wastewater Facility Inspection Report

Permit #	VA0073318

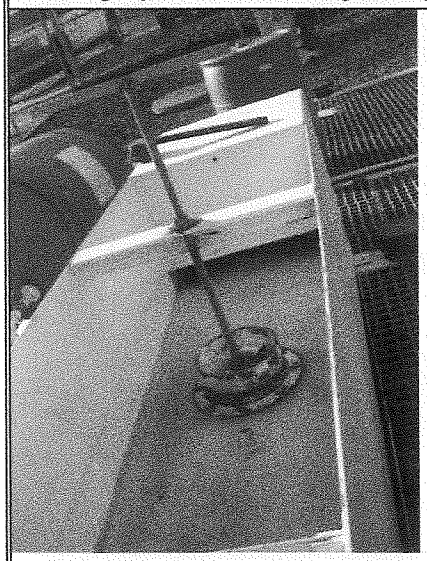
Digital Photographs taken 1/9/13



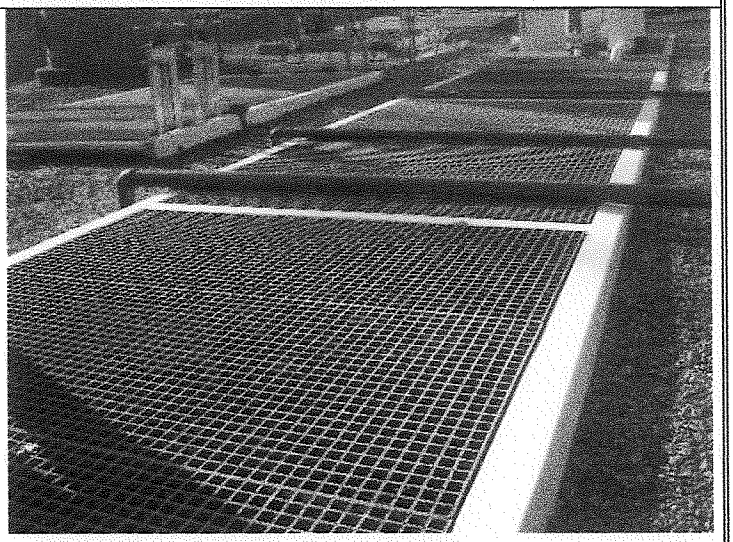
Photograph 1: Screening and grit removal



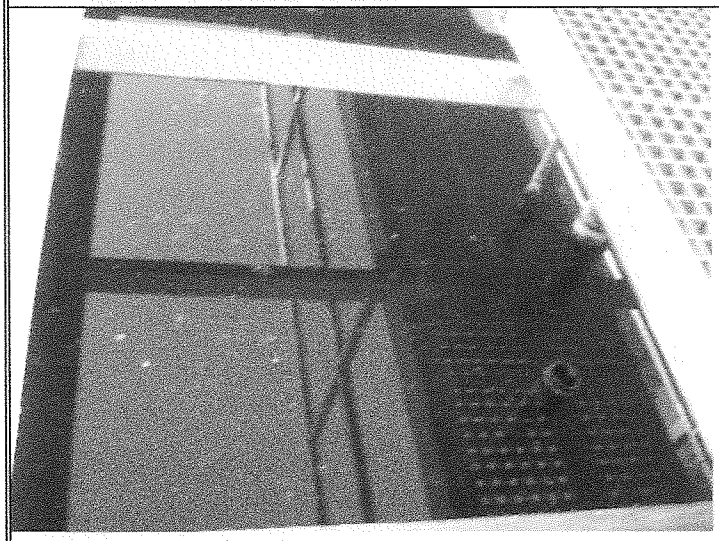
Photograph 2: Comminutor



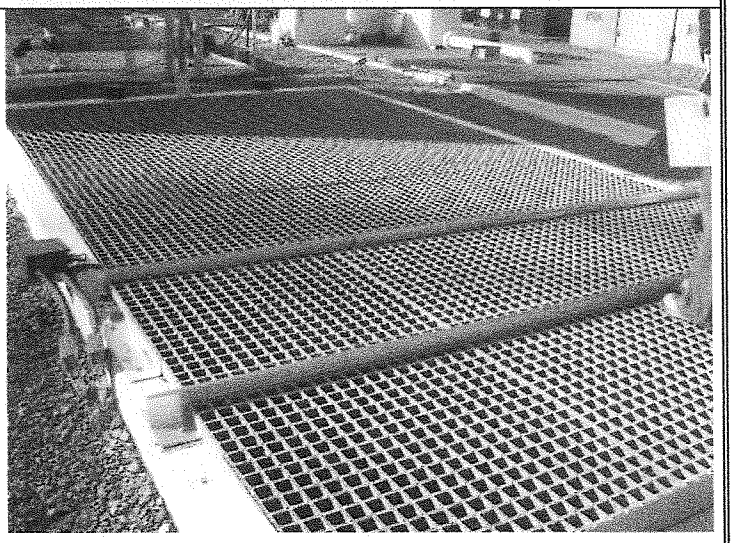
Photograph 3: Splitter Valve



Photograph 4: Aeration tank overview



Photograph 5: Clarifier

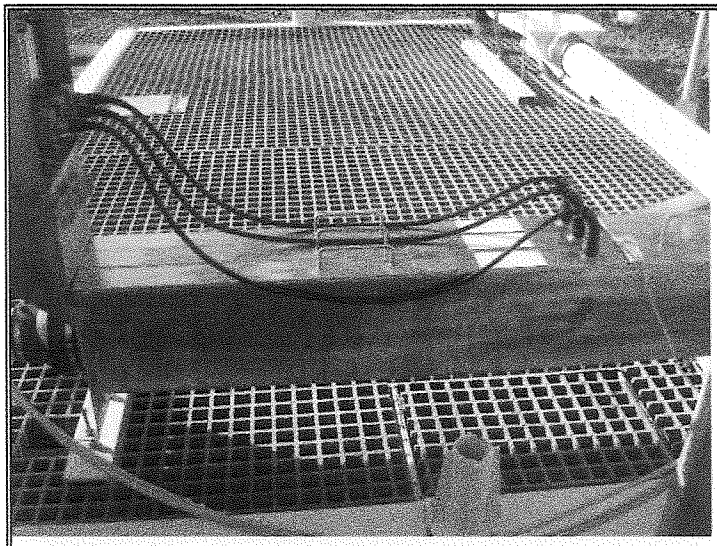


Photograph 6: Sand filter chamber

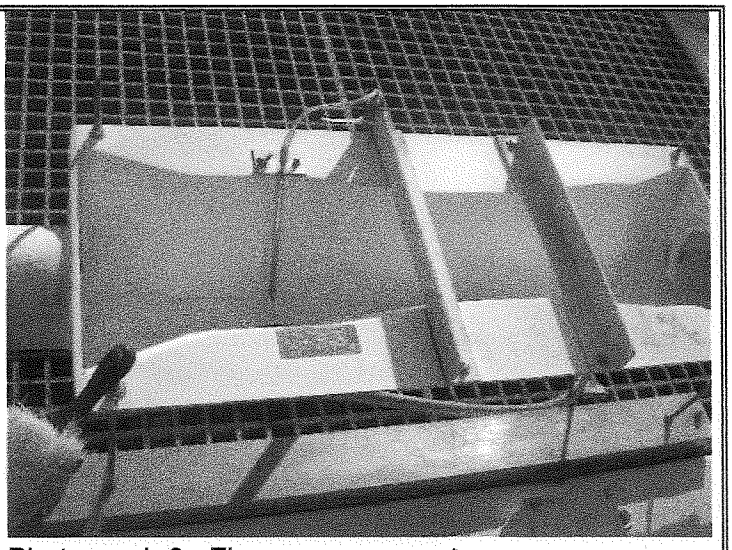
VA DEQ Wastewater Facility Inspection Report

Permit #	VA0073318

Digital Photographs taken 1/9/13



Photograph 7: UV disinfection



Photograph 8: Flow measurement

Photograph 9: Outfall 001

DEPARTMENT OF ENVIRONMENTAL QUALITY - WATER DIVISION
LABORATORY INSPECTION REPORT

12/2010

PERMIT #:	INSPECTION DATE:	PREVIOUS INSP. DATE:	PREVIOUS EVALUATION:	TIME SPENT:
VA0073318	January 9, 2013	May 14, 2008	No Deficiencies	8 hours w/ travel & report

NAME/ADDRESS OF FACILITY:	FACILITY CLASS:	FACILITY TYPE:	UNANNOUNCED INSPECTION?
HRSD-Central Middlesex STP 170 Oak Landing Road Saluda, VA 23149	( ) MAJOR ( ) MINOR (X) SMALL ( ) VPA	(X) MUNICIPAL ( ) INDUSTRIAL ( ) FEDERAL ( ) COMMERCIAL or Contract LAB	(X) YES ( ) NO **FFY-SCHEDULED INSPECTION?** (X) YES ( ) NO

INSPECTOR(S):	REVIEWERS:	PRESENT AT INSPECTION:
MRW 1/11/13 Meredith Williams, Heather Deihls	hald 1·15·13 Kim 1/16/13	Zack Crowell, Brandon Wood, Sam Henderson

LABORATORY EVALUATION	DEFICIENCIES? Yes	No
LABORATORY RECORDS		X
GENERAL SAMPLING & ANALYSIS		X
LABORATORY EQUIPMENT		X
DISSOLVED OXYGEN ANALYSIS PROCEDURES		X
pH ANALYSIS PROCEDURES		X

QUALITY ASSURANCE/QUALITY CONTROL

Y/N	QUALITY ASSURANCE METHOD	PARAMETERS	FREQUENCY
N/A	REPLICATE SAMPLES		
N/A	SPIKED SAMPLES		
N/A	STANDARD SAMPLES		
N/A	SPLIT SAMPLES		
N/A	SAMPLE BLANKS		
N/A	OTHER		
N/A	EPA-DMR QA DATA?	RATING: ( ) No Deficiency ( ) Deficiency (X) NA	
N/A	QC SAMPLES PROVIDED?	RATING: ( ) No Deficiency ( ) Deficiency (X) NA	

COPIES TO: (X) DEQ - RO; ( ) DEQ CO – OPWCA; (X) OWNER; ( ) EPA-Region III; ( ) Other:

PERMIT #: VA0073318

LABORATORY RECORDS SECTION

LABORATORY RECORDS INCLUDE THE FOLLOWING:

X	SAMPLING DATE	X	ANALYSIS DATE	N/A	CONT MONITORING CHART
X	SAMPLING TIME	X	ANALYSIS TIME	X	INSTRUMENT CALIBRATION
X	SAMPLE LOCATION	X	TEST METHOD	X	INSTRUMENT MAINTENANCE
				HRSD-Central Lab	CERTIFICATE OF ANALYSIS

WRITTEN INSTRUCTIONS INCLUDE THE FOLLOWING:

X	SAMPLING SCHEDULES	X	CALCULATIONS	X	ANALYSIS PROCEDURES

	YES	NO	N/A
DO ALL ANALYSTS INITIAL THEIR WORK?	X		
DO BENCH SHEETS INCLUDE ALL INFORMATION NECESSARY TO DETERMINE RESULTS?	X		
IS THE DMR COMPLETE AND CORRECT? MONTH(S) REVIEWED: **November 2012 DMRs and associated data.**	X		
ARE ALL MONITORING VALUES REQUIRED BY THE PERMIT REPORTED?	X		

GENERAL SAMPLING AND ANALYSIS SECTION

	YES	NO	N/A
ARE SAMPLE LOCATION(S) ACCORDING TO PERMIT REQUIREMENTS?	X		
ARE SAMPLE COLLECTION PROCEDURES APPROPRIATE?	X		
IS SAMPLE EQUIPMENT CONDITION ADEQUATE?	X		
IS FLOW MEASUREMENT ACCORDING TO PERMIT REQUIREMENTS?	X		
ARE COMPOSITE SAMPLES REPRESENTATIVE OF FLOW?			X
ARE SAMPLE HOLDING TIMES AND PRESERVATION ADEQUATE?	X		
IF ANALYSIS IS PERFORMED AT ANOTHER LOCATION, ARE SHIPPING PROCEDURES ADEQUATE? LIST PARAMETERS AND NAME & ADDRESS OF LAB: **HRSD Central Laboratory - $cBOD_5$, TSS. TKN, E. Coli, Fecal Coliform, Copper**	X		

ANALYTICAL EQUIPMENT SECTION

	YES	NO	N/A
IS ANALYTICAL EQUIPMENT IN PROPER OPERATING RANGE?	X		
ARE ANNUAL THERMOMETER CALIBRATION(S) ADEQUATE?	X		
IS THE LABORATORY GRADE WATER SUPPLY ADEQUATE?			X
ARE ANALYTICAL BALANCE(S) ADEQUATE?			X

DEPARTMENT OF ENVIRONMENTAL QUALITY – WATER DIVISION
LABORATORY INSPECTION REPORT SUMMARY

12/2010

FACILITY NAME:	**HRSD-Central Middlesex STP**	Permit #:	**VA0073318**	INSPECTION DATE:	**January 9, 2013**

LABORATORY EVALUATION	X	No Deficiencies
		Deficiency ***[REQUIRED CORRECTIVE ACTIONS]***

LABORATORY RECORDS

In May 2012, EPA issued a final rule to approve several new or revised analytical methods for measuring regulated pollutants in wastewater. This rule is also called the Methods Update Rule (MUR). One of the changes in this MUR is the naming convention used for citing Standard Methods. Citing the edition of Standard Methods is no longer applicable; now the citation must include the "**date tag**" in which the method was approved. Also note that for pH, D.O. and TRC, the 18th and 19th Editions of Standard Methods are no longer approved. Only the 20th, 21st and online Editions are approved. The current method citations are:

D.O.: SM4500-O G **-2001**
pH: SM4500-H^+ B **-2000**

Laboratory Records section deficiency and required action:

1. None.

GENERAL SAMPLING AND ANALYSIS

General Sampling and Analysis section deficiency and required action:

1. None.

LABORATORY EQUIPMENT

Laboratory Equipment section deficiency and required action:

1. None.

PARAMETER SUMMARY

pH

pH deficiency and required action:

1. None.

Dissolved Oxygen (D.O.)

D.O. deficiency and required action:

1. None.

ANALYST:	**Brandon Wood**	VPDES NO	**VA0073318**

Meter: **YSI 550A**

Parameter: Dissolved Oxygen
Method: Membrane Electrode
Facility Elevation ~100'
1/08

METHOD OF ANALYSIS:

	18th Edition of Standard Methods – 4500-O G
X	20th , 21st or Online Editions of Standard Methods – 4500-O G 2001

	DO is a method-defined analyte so modifications are not allowed. [40 CFR Part 136.6]	**Y**	**N**
1)	If samples are collected, is collection carried out with a minimum of turbulence and air bubble formation and is the sample bottle allowed to overflow several times its volume? [1.c]	**In situ**	
2)	Are meter and electrode operable and providing consistent readings? [3]	**X**	
3)	Is membrane in good condition without trapped air bubbles? [3.b]	**X**	
4)	Is correct filling solution used in electrode? [Mfr.]	**X**	
5)	Are water droplets shaken off the membrane prior to calibration? [Mfr.]	**X**	
6)	Is meter calibrated before use or at least daily? [Mfr. & Part 1020]	**X**	
7)	Is calibration procedure performed according to manufacturer's instructions? [Mfr.]	**X**	
8)	Is sample stirred during analysis? [Mfr.]	**In situ**	
9)	Is the sample analysis procedure performed according to manufacturer's instructions? [Mfr.]	**X**	
10)	Is meter stabilized before reading D.O.? [Mfr.]	**X**	
11)	Is electrode stored according to manufacturer's instructions? [Mfr.]	**X**	
12)	Is a duplicate sample analyzed after every 20 samples if citing 18th or 19th Edition or daily if citing 20th or 21st Edition? [Part 1020] **NOTE**: Not required for *in situ* samples.	**Duplicates are no longer required by DEQ.**	
13)	If a duplicate sample is analyzed, is the reported value for that sampling event the average concentration of the sample and the duplicate? [DEQ]		
14)	If a duplicate sample is analyzed, is the relative percent difference (RPD) ≤ 20? [18th ed. Table 1020 I; 21st ed. DEQ]		

PROBLEMS: Preventative Maintenance is performed weekly. Membrane is changed every 3-6 weeks.

ANALYST:	**Brandon Wood**	VPDES NO	**VA0073318**

Meter: **Thermo Scientific pH meter**

Parameter: Hydrogen Ion (pH)
1/08

Method: Electrometric

METHOD OF ANALYSIS:

	18th Edition of Standard Methods – 4500-H^+ B
X	21st or Online Editions of Standard Methods – 4500-H^+ B 2000

	pH is a method-defined analyte so modifications are not allowed. [40 CFR Part 136.6]	**Y**	**N**
1)	Is a certificate of operator competence or initial demonstration of capability available for each analyst/operator performing this analysis? **NOTE**: Analyze 4 samples of known pH. May use external source of buffer (different lot/manufacturer than buffers used to calibrate meter). Recovery for each of the 4 samples must be +/- 0.1 SU of the known concentration of the sample. [SM 1020 B.1]	X	
2)	Is the electrode in good condition (no chloride precipitate, scratches, deterioration, etc.)? [2.b/c and 5.b]	X	
3)	Is electrode storage solution in accordance with manufacturer's instructions? [Mfr.]	X	
4)	Is meter calibrated on at least a daily basis using three buffers all of which are at the same temperature? [4.a] **NOTE**: Follow manufacturer's instructions.	X	
5)	After calibration, is a buffer analyzed as a check sample to verify that calibration is correct? Agreement should be within +/- 0.1 SU. [4.a]	X	
6)	Do the buffer solutions appear to be free of contamination or growths? [3.1]	X	
7)	Are buffer solutions within the listed shelf-life or have they been prepared within the last 4 weeks? [3.a]	X	
8)	Is the cap or sleeve covering the access hole on the reference electrode removed when measuring pH? [Mfr.]	X	
9)	For meters with ATC that also have temperature display, is the thermometer verified annually? [SM 2550 B.1]	X	
10)	Is temperature of buffer solutions and samples recorded when determining pH? [4.a]	X	
11)	Is sample analyzed within 15 minutes of collections? [40 CFR Part 136]	X	
12)	Is the electrode rinsed and then blotted dry between reading solutions (Disregard if a portion of the next sample analyzed is used as the rinsing solution.)? [4.a]	X	
13)	Is the sample stirred gently at a constant speed during measurement? [4.b]	X	
14)	Does the meter hold a steady reading after reaching equilibrium? [4.b]	X	
15)	Is a duplicate sample analyzed after every 20 samples if citing 18th or 19th Edition or daily for 20th or 21st Edition? [Part 1020] **NOTE**: Not required for *in situ* samples.	**DEQ no longer requires duplicates to be analyzed.**	
16)	Is the pH of duplicate samples within 0.1SU of the original sample? [Part 1020]		
17)	Is there a written procedure for which result will be reported on DMR (Sample or Duplicate) and is this procedure followed? [DEQ]		

PROBLEMS: None.

Comments: Preventative Maintenance is performed weekly.

DEPARTMENT OF ENVIRONMENTAL QUALITY - WATER DIVISION
SAMPLE ANALYSIS HOLDING TIME/CONTAINER/PRESERVATION CHECK SHEET
Revised 3/08 [40 CFR, Part 136.3, Table II]

FACILITY NAME:	**HRSD-Central Middlesex STP**	VPDES NO	**VA0073318**	DATE:	**January 9, 2013**

HOLDING TIMES						SAMPLE CONTAINER				PRESERVATION				
PARAMETER	APPROVED	MET?		LOGGED?		ADEQ. VOLUME		APPROP. TYPE		APPROVED	MET?		CHECKED?	
		Y	N	Y	N	Y	N	Y	N		Y	N	Y	N
BOD5 & CBOD5	48 HOURS	X		X		X		X		ANALYZE 2 HRS or 6°C	X		X	
TSS	7 DAYS	X								6°C				
FECAL COLIFORM / *E. coli / Enterococci*	6 HRS & 2 HRS TO PROCESS	X		X		X		X		10°C (1 HOUR)+ 0.008% $Na_2S_2O_3$	X		X	
pH	15 MIN.	X		X		X		X		N/A				
CHLORINE	15 MIN.									N/A				
DISSOLVED 0_2	15 MIN./IN SITU	X		X		X		X		N/A				
TEMPERATURE	IMMERSION STAB.									N/A				
OIL & GREASE	28 DAYS									6°C + H_2SO_4/HCL pH<2				
AMMONIA	28 DAYS	X		X		X		X		6°C + H_2S0_4 pH<2 DECHLOR	X		X	
TKN	28 DAYS	X		X		X		X		6°C + H_2S0_4 pH<2 DECHLOR	X		X	
NITRATE	48 HOURS									6°C				
NITRATE+NITRITE	28 DAYS									6°C + H_2S0_4 pH<2				
NITRITE	48 HOURS									6°C				
PHOSPHATE, ORTHO	48 HOURS									FILTER, 6°C				
TOTAL PHOS.	28 DAYS									6°C+ H_2S0_4 pH<2				
METALS (except Hg)	6 MONTHS	X		X		X		X		HNO_3 pH<2	X		X	
MERCURY (CVAA)	28 DAYS									HNO_3 pH<2				

PROBLEMS: None.	PROBLEMS: None.

DEPARTMENT OF ENVIRONMENTAL QUALITY - WATER DIVISION
EQUIPMENT TEMPERATURE LOG/THERMOMETER VERIFICATION CHECK SHEET
1/08

FACILITY NAME:	HRSD-Central Middlesex STP	VPDES NO:	VA0073318	DATE:	January 9, 2013

EQUIPMENT	RANGE	IN RANGE		INSPECT READING °C	CHECK & LOG DAILY		CORRECT INCREMENT		ANNUAL THERMOMETER VERIFICATION				
									Is the NIST / NIST-Traceable Reference Thermometer within the manufacturer's expiration date or recertified yearly?			Y/N	
									DATE CHECKED	MARKED		CORR FACTOR	INSPECT TEMP
		Y	N		Y	N	Y	N		Y	N	°C	°C
SAMPLE REFRIGER.	1-6°C	X		1°C	X		X		4/20/12	X		0	1°C
AUTO SAMPLER	1-6° C								N/A				
BOD INCUBATOR	20 ± 1° C												
SOLIDS DRYING OVEN	103-105° C												
WATER BATH	44.5 ± 0.2° C												
INCUBATOR	35± 0° C												
AUTOCLAVE	121° C IN 30 MIN												
HOT AIR STERILIZING	170 ± 10° C												
O & G WATER BATH	70 ± 2° C												
REAGENT REFRIGER.	1-6° C												
pH METER	± 1° C			Not on					12/11/12	X		0	--
DO METER	± 1° C	X		18.6°C					12/11/12	X		0	18.6°
THERMOMETER-OUTFALL	± 1° C												
Hg WATER BATH	95 °C												

PROBLEMS: None.
COMMENTS: Samples are collected and placed in the sample refrigerator. A courier picks up samples and hand delivers to HRSD-Central Laboratory.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
DISCHARGE MONITORING REPORT (DMR)

MUNICIPAL MINOR 1/18/2012

RECEIVED
DEC 11 2012
PRO

DEPT OF ENVIRONMENTAL QUALITY
(REGIONAL OFFICE)
PIEDMONT REGIONAL OFFICE
4949-A COX ROAD
GLEN ALLEN, VA 23060

NAME: HAMPTON ROADS SANITATION DISTRICT
ADDRESS: P.O. BOX 5911
VIRGINIA BEACH, VA 23471
Facility: Central Middlesex STP
Location: 170 Oak Landing Rd, Saluda

VA0073318	001
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD

	YEAR /MO /DAY		YEAR /MO /DAY
FROM	12/11/01	TO	12/11/30

PARAMETER		QUANTITY OR LOADING			QUALITY OR CONCENTRATION				NO. EX.	Frequency of Analysis	Sample type
		Average	Maximum	Units	Minimum	Average	Maximum	Units			
001 FLOW	REPORTED	0.020	0.030	MGD	*********	*******	*********			1/DAY	EST
	PERMIT REQUIREMENT	0.025	NL	MGD	*********	*******	*********			1/DAY	EST
002 PH	REPORTED	*********	*********		7.4	*******	8.6	SU	0	1/DAY	GRAB
	PERMIT REQUIREMENT	*********	*********		6.0	*******	9.0	SU	0	1/DAY	GRAB
004 TOTAL SUS. SOLIDS	REPORTED	<QL	<QL	G/D	*********	<QL	<QL	MG/L	0	1/M	GRAB
	PERMIT REQUIREMENT	1000	1600	G/D	*********	11	16	MG/L	0	1/M	GRAB
006 FECAL COLIFORM	REPORTED	*********	*********		*********	1	1	N/CML	0	1/W	GRAB
	PERMIT REQUIREMENT	*********	*********		*********	20	NL	N/CML	0	1/W	GRAB
007 DO	REPORTED	*********	*********		8.3	********	*********	MG/L	0	1/DAY	GRAB
	PERMIT REQUIREMENT	*********	*********		6.5	********	*********	MG/L	0	1/DAY	GRAB
039 AMMONIA, AS N	REPORTED	*********	*********		********	<QL	<QL	MG/L		1/M	GRAB
	PERMIT REQUIREMENT	*********	*********		********	NL	NL	MG/L		1/M	GRAB
068 TKN (N-KJEL)	REPORTED	48	48	G/D	*********	0.60	0.60	MG/L	0	1/M	GRAB
	PERMIT REQUIREMENT	300	430	G/D	*********	3.0	4.5	MG/L	0	1/M	GRAB
120 E. COLI	REPORTED	*********	*********		*********	1	1	N/CML	0	1/W	GRAB
	PERMIT REQUIREMENT	*********	*********		*********	126	NL	N/CML	0	1/W	GRAB

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS

BYPASSES AND OVERFLOWS	TOTAL OCCURENCES	TOTAL FLOW (MG)	TOTAL BOD5 (KG)
	0	0	0

OPERATOR IN RESPONSIBLE CHARGE			DATE
G. DAVID WALTRIP	G David Waltrip	1965003759	12/12/07
TYPED OR PRINTED NAME	SIGNATURE	CERTIFICATE NO.	YR-MO-DAY

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See USC §1001 and 33 USC §1319. Penalties under these statutes may include fines up to $10,000 and/or maximum imprisonment of between 6 months and 5 years.

PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT		TELEPHONE	DATE
JAMES J. PLETL	James J Pletl	[757]460-2261	12/12/07
TYPED OR PRINTED NAME	SIGNATURE		YR-MO-DAY

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
DISCHARGE MONITORING REPORT (DMR)

MUNICIPAL MINOR 1/18/2012

NAME: HAMPTON ROADS SANITATION DISTRICT
ADDRESS: P.O. BOX 5911
VIRGINIA BEACH, VA 23471
Facility: Central Middlesex STP
Location: 170 Oak Landing Rd, Saluda

VA0073318		001
PERMIT NUMBER		DISCHARGE NUMBER
MONITORING PERIOD		
YEAR /MO /DAY		YEAR /MO /DAY
FROM 12/11/01	TO	12/11/30

RECEIVED
DEC 11 2012
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DEPT OF ENVIRONMENTAL QUALITY
(REGIONAL OFFICE)
PIEDMONT REGIONAL OFFICE
4949-A COX ROAD
GLEN ALLEN, VA 23060

PARAMETER		QUANTITY OR LOADING			QUALITY OR CONCENTRATION				NO.	Frequency of	Sample
		Average	Maximum	Units	Minimum	Average	Maximum	Units	EX.	Analysis	type
159 CBOD5	REPORTED	<QL	<QL	G/D	*********	<QL	<QL	MG/L	0	1/M	GRAB
	PERMIT REQUIREMENT	1000	1600	G/D	*********	11	16	MG/L	0	1/M	GRAB
203 COPPER, TOTAL RECOVERABLE	REPORTED	********	*********		*******	2.7	2.7	UG/L		1/M	GRAB
	PERMIT REQUIREMENT	********	*********		*******	NL	NL	UG/L		1/M	GRAB
	REPORTED										
	PERMIT REQUIREMENT										
	REPORTED										
	PERMIT REQUIREMENT										
	REPORTED										
	PERMIT REQUIREMENT										
	REPORTED										
	PERMIT REQUIREMENT										
	REPORTED										
	PERMIT REQUIREMENT										
	REPORTED										
	PERMIT REQUIREMENT										

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS

BYPASSES AND OVERFLOWS	TOTAL OCCURENCES	TOTAL FLOW (MG)	TOTAL BOD5 (KG)
	0	0	0

OPERATOR IN RESPONSIBLE CHARGE			DATE
G. DAVID WALTRIP	G. David Waltrip	1965003759	12/12/07
TYPED OR PRINTED NAME	SIGNATURE	CERTIFICATE NO.	YR-MO-DAY
PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT		TELEPHONE	DATE
JAMES J. PLETL	James J. Pletl	[757]460-2261	12/12/07
TYPED OR PRINTED NAME	SIGNATURE		YR-MO-DAY

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See USC §1001 and 33 USC §1319. Penalties under these statutes may include fines up to $10,000 and/or maximum imprisonment of between 6 months and 5 years.

Mid Pen Sec. Ctr STP

A. Limitations and Monitoring Requirements

1. During the period beginning with the permit's effective date and lasting until the conclusion of the schedule of compliance in Part I.B, the permittee is authorized to discharge from outfall number 001. This discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	MONTHLY AVERAGE		WEEKLY AVERAGE		MINIMUM	MAXIMUM	FREQUENCY	SAMPLE TYPE
Flow (MGD) [1]	NL		NA		NA	NL	1 per Day	Estimate
pH (standard units)	NA		NA		6.0	9.0	1 per Day	Grab
$cBOD_5$ [2]	11 mg/L	1000 g/d	16 mg/L	1600 g/d	NA	NA	1 per Month	Grab
Total Suspended Solids (TSS) [2]	11 mg/L	1000 g/d	16 mg/L	1600 g/d	NA	NA	1 per Month	Grab
Total Kjeldahl Nitrogen (TKN) [2]	3.0 mg/L	300 g/d	4.5 mg/L	430 g/d	NA	NA	1 per Month	Grab
Ammonia as N [3]	NL (mg/L)		NL (mg/L)		NA	NA	1 per Month	Grab
Dissolved Oxygen	NA		NA		6.5 mg/L	NA	1 per Day	Grab
E. Coli	126 N/100mL (Geometric Mean)		NA		NA	NL	1 per Week	Grab (between 10am-4pm)
Fecal Coliform	20 N/100mL (Geometric Mean)		NA		NA	NL	1 per Week	Grab (between 10am-4pm)
Copper, Total Recoverable [3]	NL (µg/L)		NL(µg/L)		NA	NL	1 per Month	Grab

"NL" means no limitation is established. Monitoring and reporting are required.
"NA" means not applicable.

[1]The design flow of this treatment facility is 0.025 MGD. See Part I.C.1 for additional flow requirements.
[2]This limitation is expressed in two significant digits.
[3]See Part I.B. for a Schedule of Compliance. During the schedule of compliance period, the permittee shall submit monitoring in accordance with the monitoring frequency and sample type listed in Part I.A.1.

a. There shall be no discharge of floating solids or visible foam in other than trace amounts.

b. At least 85% removal for BOD_5 and TSS must be obtained for this effluent.

Central Middlesex										Sheet No. CM1	
November, 2012										T-1 INFLUENT / EFFLUE	
12/9/12 9:44 PM											
	1	2	17	18	19	22	21	24	29	32	34
DATE	TOTAL FLOW	RAW INF TEMP	FIN EFF pH	FIN EFF DO	FECAL COLIFORM	E. COLI	FIN EFF CBOD	FIN EFF TSS	COPPER	FIN EFF NH3	FIN EFF TKN
	MGD	°c		mg/l	No/100mL	MPN/100 mL	mg/L	mg/l	ug/l	mg/l	mg/l
01-Thu	0.017		8.5	9.6							
02-Fri	0.018		8.3	9.9					2.7		
03-Sat	0.021		8.2	9.9							
04-Sun	0.019		8.4	9.9							
05-Mon	0.021		8.6	9.5	< 1	< 1	< 2	< 1.0		< 0.20	0.60
06-Tue	0.020		8.5	10.5							
07-Wed	0.019		8.4	10.8							
08-Thu	0.016		7.8	10.9							
09-Fri	0.019		8.5	10.7							
10-Sat	0.018		8.3	12.1							
11-Sun	0.023		8.2	10.9							
12-Mon	0.018		8.2	8.3	< 1	< 1					
13-Tue	0.020		8.5	9.8							
14-Wed	0.020		8.6	9.9							
15-Thu	0.020		8.4	9.8							
16-Fri	0.019		8.6	10.3							
17-Sat	0.020		8.5	10.8							
18-Sun	0.020		8.5	9.5							
19-Mon	0.020		7.4	9.7	< 1	< 1					
20-Tue	0.021		8.5	10.2							
21-Wed	0.017		8.5	10.2							
22-Thu	0.020		8.3	9.9							
23-Fri	0.021		8.5	9.7							
24-Sat	0.025		8.3	10.2							
25-Sun	0.030		8.3	10.5							
26-Mon	0.018		8.2	10.6	< 1	< 1					
27-Tue	0.019		8.3	10.2							
28-Wed	0.021		8.5	10.1							
29-Thu	0.021		8.2	10.8							
30-Fri	0.017		8.3	10.5							
TOTAL	0.598										
MAX	0.030		8.6	12.1	1	1		1.0	2.7	0.2	0.60
MIN	0.016		7.4	8.3	1	1		1.0	2.7	0.2	0.60
AVG	0.020		8.3	10.2	1	1		1.0	2.7	0.2	0.60

Attachment D: DMR and Application Effluent Data

Facility Name:HRSD Central Middlesex STP **Permit No:VA0073318**

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	**FLOW**	0.018	0.033	NULL	NULL	NULL	10-Sep-11
		0.020	0.027	NULL	NULL	NULL	10-Oct-11
		0.018	0.027	NULL	NULL	NULL	10-Nov-11
		0.020	0.025	NULL	NULL	NULL	10-Dec-11
		0.020	0.033	NULL	NULL	NULL	10-Jan-12
		0.021	0.032	NULL	NULL	NULL	10-Mar-12
		0.022	0.031	NULL	NULL	NULL	10-Apr-12
		0.021	0.043	NULL	NULL	NULL	10-May-12
		0.021	0.042	NULL	NULL	NULL	10-Jun-12
		0.021	0.026	NULL	NULL	NULL	10-Jul-12
		0.021	0.068	NULL	NULL	NULL	10-Aug-12
		0.020	0.026	NULL	NULL	NULL	10-Sep-12
		0.020	0.024	NULL	NULL	NULL	10-Oct-12
		0.021	0.030	NULL	NULL	NULL	10-Nov-12
		0.020	0.030	NULL	NULL	NULL	10-Dec-12
		0.021	0.031	NULL	NULL	NULL	10-Jan-13
		0.025	0.039	NULL	NULL	NULL	10-Feb-13
		0.023	0.039	NULL	NULL	NULL	10-Mar-13
		0.024	0.036	NULL	NULL	NULL	10-Apr-13
		0.024	0.033	NULL	NULL	NULL	10-May-13
		0.021	0.028	NULL	NULL	NULL	10-Jun-13
		0.023	0.038	NULL	NULL	NULL	10-Jul-13
		0.022	0.032	NULL	NULL	NULL	10-Aug-13
		0.024	0.029	NULL	NULL	NULL	10-Sep-13
		0.025	0.030	NULL	NULL	NULL	10-Oct-13
		0.027	0.031	NULL	NULL	NULL	10-Nov-13
		0.027	0.035	NULL	NULL	NULL	10-Dec-13
		0.027	0.034	NULL	NULL	NULL	10-Jan-14
		0.029	0.044	NULL	NULL	NULL	10-Feb-14
		0.027	0.035	NULL	NULL	NULL	10-Mar-14
		0.023	0.046	NULL	NULL	NULL	10-Apr-14
		0.023	0.028	NULL	NULL	NULL	10-May-14
		0.023	0.027	NULL	NULL	NULL	10-Jun-14
		0.025	0.031	NULL	NULL	NULL	10-Jul-14
		0.029	0.033	NULL	NULL	NULL	10-Aug-14
		0.025	0.035	NULL	NULL	NULL	10-Sep-14
		0.018	0.024	NULL	NULL	NULL	10-Oct-14
		0.015	0.018	NULL	NULL	NULL	10-Nov-14
		0.015	0.025	NULL	NULL	NULL	10-Dec-14
		0.015	0.031	NULL	NULL	NULL	10-Jan-15
		0.022	0.057	NULL	NULL	NULL	10-Feb-15
		0.029	0.084	NULL	NULL	NULL	10-Mar-15
		0.018	0.044	NULL	NULL	NULL	10-Apr-15
		0.013	0.017	NULL	NULL	NULL	10-May-15
		0.014	0.024	NULL	NULL	NULL	10-Jun-15
		0.016	0.024	NULL	NULL	NULL	10-Jul-15
	pH (S.U.)	NULL	NULL	NULL	8.3	8.8	10-Sep-11
		NULL	NULL	NULL	8.3	8.8	10-Oct-11
		NULL	NULL	NULL	8.4	8.8	10-Nov-11

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	pH (S.U.)	NULL	NULL	NULL	7.7	8.9	10-Dec-11
		NULL	NULL	NULL	7.6	8.8	10-Jan-12
		NULL	NULL	NULL	8.2	8.7	10-Mar-12
		NULL	NULL	NULL	8.1	8.8	10-Apr-12
		NULL	NULL	NULL	8.1	8.7	10-May-12
		NULL	NULL	NULL	8.1	8.7	10-Jun-12
		NULL	NULL	NULL	8	8.9	10-Jul-12
		NULL	NULL	NULL	8.1	8.6	10-Aug-12
		NULL	NULL	NULL	8.2	8.7	10-Sep-12
		NULL	NULL	NULL	8	8.8	10-Oct-12
		NULL	NULL	NULL	8.2	8.8	10-Nov-12
		NULL	NULL	NULL	7.4	8.6	10-Dec-12
		NULL	NULL	NULL	8.2	8.7	10-Jan-13
		NULL	NULL	NULL	8.2	8.6	10-Feb-13
		NULL	NULL	NULL	8.2	8.7	10-Mar-13
		NULL	NULL	NULL	8.2	8.7	10-Apr-13
		NULL	NULL	NULL	8	8.6	10-May-13
		NULL	NULL	NULL	8.2	8.7	10-Jun-13
		NULL	NULL	NULL	7.7	8.5	10-Jul-13
		NULL	NULL	NULL	7.6	8.5	10-Aug-13
		NULL	NULL	NULL	8.1	8.7	10-Sep-13
		NULL	NULL	NULL	7.6	8.6	10-Oct-13
		NULL	NULL	NULL	7.7	8.6	10-Nov-13
		NULL	NULL	NULL	8	8.5	10-Dec-13
		NULL	NULL	NULL	8	8.5	10-Jan-14
		NULL	NULL	NULL	7.9	8.6	10-Feb-14
		NULL	NULL	NULL	8	8.4	10-Mar-14
		NULL	NULL	NULL	7.2	8.3	10-Apr-14
		NULL	NULL	NULL	7	8.4	10-May-14
		NULL	NULL	NULL	7.5	8.5	10-Jun-14
		NULL	NULL	NULL	7.9	8.6	10-Jul-14
		NULL	NULL	NULL	8	8.6	10-Aug-14
		NULL	NULL	NULL	7.6	8.6	10-Sep-14
		NULL	NULL	NULL	7.3	8.5	10-Oct-14
		NULL	NULL	NULL	7.2	8.3	10-Nov-14
		NULL	NULL	NULL	7.1	8.8	10-Dec-14
		NULL	NULL	NULL	7.3	8.4	10-Jan-15
		NULL	NULL	NULL	6.8	8.4	10-Feb-15
		NULL	NULL	NULL	7.2	8.4	10-Mar-15
		NULL	NULL	NULL	7.9	8.4	10-Apr-15
		NULL	NULL	NULL	7.6	8.3	10-May-15
		NULL	NULL	NULL	6.5	8.7	10-Jun-15
		NULL	NULL	NULL	7.3	8.4	10-Jul-15
				10%	**7.2**	**8.4**	
				90%	**8.2**	**8.8**	
	TSS (mg/L)	<QL	<QL	<QL	NULL	<QL	10-Nov-11
		157	157	2.3	NULL	2.3	10-Mar-12
		<QL	<QL	<QL	NULL	<QL	10-Apr-12
		68	68	1.0	NULL	1.0	10-May-12
		<QL	<QL	<QL	NULL	<QL	10-Jun-12
		293	293	4.3	NULL	4.3	10-Jul-12

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	TSS (mg/L)	204	204	3.0	NULL	3.0	10-Aug-12
		<QL	<QL	<QL	NULL	<QL	10-Sep-12
		64	64	1.0	NULL	1.0	10-Oct-12
		<QL	<QL	<QL	NULL	<QL	10-Nov-12
		<QL	<QL	<QL	NULL	<QL	10-Dec-12
		<QL	<QL	<QL	NULL	<QL	10-Jan-13
		<QL	<QL	<QL	NULL	<QL	10-Feb-13
		<QL	<QL	<QL	NULL	<QL	10-Mar-13
		<QL	<QL	<QL	NULL	<QL	10-Apr-13
		326	326	4.1	NULL	4.1	10-May-13
		127	127	1.2	NULL	1.2	10-Jun-13
		194	194	1.9	NULL	1.9	10-Jul-13
		<QL	<QL	<QL	NULL	<QL	10-Aug-13
		<QL	<QL	<QL	NULL	<QL	10-Sep-13
		<QL	<QL	<QL	NULL	<QL	10-Oct-13
		<QL	<QL	<QL	NULL	<QL	10-Nov-13
		212	212	2.0	NULL	2.0	10-Dec-13
		87	87	1.0	NULL	1.0	10-Jan-14
		150	150	1.1	NULL	1.1	10-Feb-14
		<QL	<QL	<QL	NULL	<QL	10-Mar-14
		<QL	<QL	<QL	NULL	<QL	10-Apr-14
		<QL	<QL	<QL	NULL	<QL	10-May-14
		416	416	5.0	NULL	5.0	10-Jun-14
		388	388	4.1	NULL	4.1	10-Jul-14
		<QL	<QL	<QL	NULL	<QL	10-Aug-14
		<QL	<QL	<QL	NULL	<QL	10-Sep-14
		<QL	<QL	<QL	NULL	<QL	10-Oct-14
		109	109	1.6	NULL	1.6	10-Nov-14
		<QL	<QL	<QL	NULL	<QL	10-Dec-14
		<QL	<QL	<QL	NULL	<QL	10-Jan-15
		57	57	1.0	NULL	1.0	10-Feb-15
		<QL	<QL	<QL	NULL	<QL	10-Mar-15
		<QL	<QL	<QL	NULL	<QL	10-Apr-15
		<QL	<QL	<QL	NULL	<QL	10-May-15
		<QL	<QL	<QL	NULL	<QL	10-Jun-15
		95	95	1.2	NULL	1.2	10-Jul-15
	COLIFORM, FECAL (N/100 mL)	NULL	NULL	1	NULL	1	10-Sep-11
		NULL	NULL	1	NULL	1	10-Oct-11
		NULL	NULL	1	NULL	1	10-Nov-11
		NULL	NULL	1	NULL	1	10-Dec-11
		NULL	NULL	1	NULL	1	10-Jan-12
		NULL	NULL	1	NULL	1	10-Mar-12
		NULL	NULL	1	NULL	1	10-Apr-12
		NULL	NULL	1	NULL	2	10-May-12
		NULL	NULL	1	NULL	1	10-Jun-12
		NULL	NULL	4	NULL	32	10-Jul-12
		NULL	NULL	1	NULL	3	10-Aug-12
		NULL	NULL	1	NULL	1	10-Sep-12
		NULL	NULL	1	NULL	1	10-Oct-12
		NULL	NULL	1	NULL	1	10-Nov-12

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	COLIFORM, FECAL (N/100 mL)	NULL	NULL	1	NULL	1	10-Dec-12
		NULL	NULL	1	NULL	1	10-Jan-13
		NULL	NULL	1	NULL	1	10-Feb-13
		NULL	NULL	1	NULL	4	10-Mar-13
		NULL	NULL	1	NULL	5	10-Apr-13
		NULL	NULL	1	NULL	1	10-May-13
		NULL	NULL	1	NULL	2	10-Jun-13
		NULL	NULL	3	NULL	74	10-Jul-13
		NULL	NULL	1	NULL	5	10-Aug-13
		NULL	NULL	1	NULL	1	10-Sep-13
		NULL	NULL	1	NULL	1	10-Oct-13
		NULL	NULL	1	NULL	1	10-Nov-13
		NULL	NULL	1	NULL	1	10-Dec-13
		NULL	NULL	1	NULL	1	10-Jan-14
		NULL	NULL	1	NULL	1	10-Feb-14
		NULL	NULL	1	NULL	4	10-Mar-14
		NULL	NULL	1	NULL	1	10-Apr-14
		NULL	NULL	1	NULL	1	10-May-14
		NULL	NULL	1	NULL	1	10-Jun-14
		NULL	NULL	1	NULL	1	10-Jul-14
		NULL	NULL	1	NULL	1	10-Aug-14
		NULL	NULL	1	NULL	2	10-Sep-14
		NULL	NULL	1	NULL	1	10-Oct-14
		NULL	NULL	1	NULL	2	10-Nov-14
		NULL	NULL	1	NULL	2	10-Dec-14
		NULL	NULL	1	NULL	1	10-Jan-15
		NULL	NULL	1	NULL	2	10-Feb-15
		NULL	NULL	1	NULL	1	10-Mar-15
		NULL	NULL	1	NULL	3	10-Apr-15
		NULL	NULL	1	NULL	1	10-May-15
		NULL	NULL	1	NULL	1	10-Jun-15
		NULL	NULL	2	NULL	9	10-Jul-15
	DO (mg/L)	NULL	NULL	NULL	7.2	NULL	10-Sep-11
		NULL	NULL	NULL	7.4	NULL	10-Oct-11
		NULL	NULL	NULL	7.6	NULL	10-Nov-11
		NULL	NULL	NULL	7.8	NULL	10-Dec-11
		NULL	NULL	NULL	7.8	NULL	10-Jan-12
		NULL	NULL	NULL	9.6	NULL	10-Mar-12
		NULL	NULL	NULL	8.5	NULL	10-Apr-12
		NULL	NULL	NULL	8.7	NULL	10-May-12
		NULL	NULL	NULL	7.9	NULL	10-Jun-12
		NULL	NULL	NULL	7.6	NULL	10-Jul-12
		NULL	NULL	NULL	7.2	NULL	10-Aug-12
		NULL	NULL	NULL	7.3	NULL	10-Sep-12
		NULL	NULL	NULL	7.2	NULL	10-Oct-12
		NULL	NULL	NULL	7.1	NULL	10-Nov-12
		NULL	NULL	NULL	8.3	NULL	10-Dec-12
		NULL	NULL	NULL	9.6	NULL	10-Jan-13
		NULL	NULL	NULL	9.3	NULL	10-Feb-13
		NULL	NULL	NULL	9.5	NULL	10-Mar-13

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	DO (mg/L)	NULL	NULL	NULL	9.6	NULL	10-Apr-13
		NULL	NULL	NULL	7.4	NULL	10-May-13
		NULL	NULL	NULL	7.7	NULL	10-Jun-13
		NULL	NULL	NULL	7.0	NULL	10-Jul-13
		NULL	NULL	NULL	6.6	NULL	10-Aug-13
		NULL	NULL	NULL	7.1	NULL	10-Sep-13
		NULL	NULL	NULL	7.0	NULL	10-Oct-13
		NULL	NULL	NULL	7.6	NULL	10-Nov-13
		NULL	NULL	NULL	8.3	NULL	10-Dec-13
		NULL	NULL	NULL	8.8	NULL	10-Jan-14
		NULL	NULL	NULL	9.8	NULL	10-Feb-14
		NULL	NULL	NULL	9.4	NULL	10-Mar-14
		NULL	NULL	NULL	10	NULL	10-Apr-14
		NULL	NULL	NULL	8.9	NULL	10-May-14
		NULL	NULL	NULL	8.0	NULL	10-Jun-14
		NULL	NULL	NULL	7.9	NULL	10-Jul-14
		NULL	NULL	NULL	7.4	NULL	10-Aug-14
		NULL	NULL	NULL	7.5	NULL	10-Sep-14
		NULL	NULL	NULL	7.2	NULL	10-Oct-14
		NULL	NULL	NULL	6.5	NULL	10-Nov-14
		NULL	NULL	NULL	8.5	NULL	10-Dec-14
		NULL	NULL	NULL	10	NULL	10-Jan-15
		NULL	NULL	NULL	10.4	NULL	10-Feb-15
		NULL	NULL	NULL	10	NULL	10-Mar-15
		NULL	NULL	NULL	9.1	NULL	10-Apr-15
		NULL	NULL	NULL	7.8	NULL	10-May-15
		NULL	NULL	NULL	7.4	NULL	10-Jun-15
		NULL	NULL	NULL	6.6	NULL	10-Jul-15
	AMMONIA, AS N (mg/L)	NULL	NULL	<QL	NULL	<QL	10-Mar-12
		NULL	NULL	<QL	NULL	<QL	10-Apr-12
		NULL	NULL	0.26	NULL	0.26	10-May-12
		NULL	NULL	<QL	NULL	<QL	10-Jun-12
		NULL	NULL	<QL	NULL	<QL	10-Jul-12
		NULL	NULL	<QL	NULL	<QL	10-Aug-12
		NULL	NULL	<QL	NULL	<QL	10-Sep-12
		NULL	NULL	<QL	NULL	<QL	10-Oct-12
		NULL	NULL	<QL	NULL	<QL	10-Nov-12
		NULL	NULL	<QL	NULL	<QL	10-Dec-12
		NULL	NULL	<QL	NULL	<QL	10-Jan-13
		NULL	NULL	0.25	NULL	0.25	10-Feb-13
		NULL	NULL	<QL	NULL	<QL	10-Mar-13
		NULL	NULL	<QL	NULL	<QL	10-Apr-13
		NULL	NULL	<QL	NULL	<QL	10-May-13
		NULL	NULL	<QL	NULL	<QL	10-Jun-13
		NULL	NULL	<QL	NULL	<QL	10-Jul-13
		NULL	NULL	<QL	NULL	<QL	10-Aug-13
		NULL	NULL	<QL	NULL	<QL	10-Sep-13
		NULL	NULL	<QL	NULL	<QL	10-Oct-13
		NULL	NULL	<QL	NULL	<QL	10-Nov-13
		NULL	NULL	<QL	NULL	<QL	10-Dec-13

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	AMMONIA, AS N (mg/L)	NULL	NULL	<QL	NULL	<QL	10-Jan-14
		NULL	NULL	<QL	NULL	<QL	10-Feb-14
		NULL	NULL	<QL	NULL	<QL	10-Mar-14
		NULL	NULL	<QL	NULL	<QL	10-Apr-14
		NULL	NULL	<QL	NULL	<QL	10-May-14
		NULL	NULL	<QL	NULL	<QL	10-Jun-14
		NULL	NULL	<QL	NULL	<QL	10-Jul-14
		NULL	NULL	<QL	NULL	<QL	10-Aug-14
		NULL	NULL	<QL	NULL	<QL	10-Sep-14
		NULL	NULL	<QL	NULL	<QL	10-Oct-14
		NULL	NULL	<QL	NULL	<QL	10-Nov-14
		NULL	NULL	<QL	NULL	<QL	10-Dec-14
		NULL	NULL	<QL	NULL	<QL	10-Jan-15
		NULL	NULL	<QL	NULL	<QL	10-Feb-15
		NULL	NULL	<QL	NULL	<QL	10-Mar-15
		NULL	NULL	<QL	NULL	<QL	10-Apr-15
		NULL	NULL	<QL	NULL	<QL	10-May-15
		NULL	NULL	<QL	NULL	<QL	10-Jun-15
		NULL	NULL	<QL	NULL	<QL	10-Jul-15
	TKN (N-KJEL) (mg/L)	<QL	<QL	<QL	NULL	<QL	10-Sep-11
		36	36	0.60	NULL	0.60	10-Oct-11
		36	36	0.63	NULL	0.63	10-Nov-11
		40	40	0.71	NULL	0.71	10-Dec-11
		<QL	<QL	<QL	NULL	<QL	10-Jan-12
		57	57	0.83	NULL	0.83	10-Mar-12
		76	76	0.96	NULL	0.96	10-Apr-12
		155	220	2.1	NULL	3.2	10-May-12
		58	58	0.73	NULL	0.73	10-Jun-12
		75	75	1.1	NULL	1.1	10-Jul-12
		74	74	1.1	NULL	1.1	10-Aug-12
		<QL	<QL	<QL	NULL	<QL	10-Sep-12
		34	34	0.53	NULL	0.53	10-Oct-12
		<QL	<QL	<QL	NULL	<QL	10-Nov-12
		48	48	0.60	NULL	0.60	10-Dec-12
		<QL	<QL	<QL	NULL	<QL	10-Jan-13
		82	82	0.94	NULL	0.94	10-Feb-13
		71	71	0.89	NULL	0.89	10-Mar-13
		82	82	0.60	NULL	0.60	10-Apr-13
		64	64	0.68	NULL	0.68	10-May-13
		73	73	0.69	NULL	0.69	10-Jun-13
		87	87	0.96	NULL	0.96	10-Jul-13
		58	58	0.77	NULL	0.77	10-Aug-13
		<QL	<QL	<QL	NULL	<QL	10-Sep-13
		48	48	0.58	NULL	0.58	10-Oct-13
		<QL	<QL	<QL	NULL	<QL	10-Nov-13
		<QL	<QL	<QL	NULL	<QL	10-Dec-13
		<QL	<QL	<QL	NULL	<QL	10-Jan-14
		75	75	0.55	NULL	0.55	10-Feb-14
		<QL	<QL	<QL	NULL	<QL	10-Mar-14

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	TKN (N-KJEL) (mg/L)	67	67	0.63	NULL	0.63	10-Apr-14
		59	59	0.71	NULL	0.71	10-May-14
		86	86	1.0	NULL	1.0	10-Jun-14
		81	81	0.86	NULL	0.86	10-Jul-14
		70	70	0.60	NULL	0.60	10-Aug-14
		128	128	1.1	NULL	1.1	10-Sep-14
		80	80	0.96	NULL	0.96	10-Oct-14
		54	54	0.79	NULL	0.79	10-Nov-14
		39	39	0.68	NULL	0.68	10-Dec-14
		33	33	0.52	NULL	0.52	10-Jan-15
		49	49	0.86	NULL	0.86	10-Feb-15
		55	55	0.86	NULL	0.86	10-Mar-15
		<QL	<QL	<QL	NULL	<QL	10-Apr-15
		40	40	0.82	NULL	0.82	10-May-15
		<QL	<QL	<QL	NULL	<QL	10-Jun-15
		<QL	<QL	<QL	NULL	<QL	10-Jul-15
	E.COLI (N/100 mL)	NULL	NULL	1	NULL	1	10-Mar-12
		NULL	NULL	1	NULL	1	10-Apr-12
		NULL	NULL	1	NULL	1	10-May-12
		NULL	NULL	1	NULL	1	10-Jun-12
		NULL	NULL	1	NULL	1	10-Jul-12
		NULL	NULL	1	NULL	1	10-Aug-12
		NULL	NULL	1	NULL	1	10-Sep-12
		NULL	NULL	1	NULL	1	10-Oct-12
		NULL	NULL	1	NULL	1	10-Nov-12
		NULL	NULL	1	NULL	1	10-Dec-12
		NULL	NULL	1	NULL	1	10-Jan-13
		NULL	NULL	1	NULL	1	10-Feb-13
		NULL	NULL	1	NULL	1	10-Mar-13
		NULL	NULL	1	NULL	1	10-Apr-13
		NULL	NULL	1	NULL	1	10-May-13
		NULL	NULL	1	NULL	1	10-Jun-13
		NULL	NULL	1	NULL	1	10-Jul-13
		NULL	NULL	1	NULL	1	10-Aug-13
		NULL	NULL	1	NULL	1	10-Sep-13
		NULL	NULL	1	NULL	1	10-Oct-13
		NULL	NULL	1	NULL	1	10-Nov-13
		NULL	NULL	1	NULL	1	10-Dec-13
		NULL	NULL	1	NULL	1	10-Jan-14
		NULL	NULL	1	NULL	1	10-Feb-14
		NULL	NULL	1	NULL	1	10-Mar-14
		NULL	NULL	1	NULL	1	10-Apr-14
		NULL	NULL	1	NULL	1	10-May-14
		NULL	NULL	1	NULL	1	10-Jun-14
		NULL	NULL	1	NULL	1	10-Jul-14
		NULL	NULL	1	NULL	1	10-Aug-14
		NULL	NULL	2	NULL	8	10-Sep-14
		NULL	NULL	1	NULL	1	10-Oct-14
		NULL	NULL	1	NULL	1	10-Nov-14
		NULL	NULL	1	NULL	1	10-Dec-14

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	E.COLI (N/100 mL)	NULL	NULL	1	NULL	1	10-Jan-15
		NULL	NULL	1	NULL	1	10-Feb-15
		NULL	NULL	1	NULL	1	10-Mar-15
		NULL	NULL	1	NULL	1	10-Apr-15
		NULL	NULL	1	NULL	1	10-May-15
		NULL	NULL	1	NULL	1	10-Jun-15
		NULL	NULL	1	NULL	1	10-Jul-15
	CBOD5 (mg/L)	<QL	<QL	<QL	NULL	<QL	10-Nov-11
		<QL	<QL	<QL	NULL	<QL	10-Mar-12
		<QL	<QL	<QL	NULL	<QL	10-Apr-12
		<QL	<QL	<QL	NULL	<QL	10-May-12
		<QL	<QL	<QL	NULL	<QL	10-Jun-12
		<QL	<QL	<QL	NULL	<QL	10-Jul-12
		<QL	<QL	<QL	NULL	<QL	10-Aug-12
		<QL	<QL	<QL	NULL	<QL	10-Sep-12
		<QL	<QL	<QL	NULL	<QL	10-Oct-12
		<QL	<QL	<QL	NULL	<QL	10-Nov-12
		<QL	<QL	<QL	NULL	<QL	10-Dec-12
		<QL	<QL	<QL	NULL	<QL	10-Jan-13
		<QL	<QL	<QL	NULL	<QL	10-Feb-13
		<QL	<QL	<QL	NULL	<QL	10-Mar-13
		<QL	<QL	<QL	NULL	<QL	10-Apr-13
		<QL	<QL	<QL	NULL	<QL	10-May-13
		<QL	<QL	<QL	NULL	<QL	10-Jun-13
		<QL	<QL	<QL	NULL	<QL	10-Jul-13
		<QL	<QL	<QL	NULL	<QL	10-Aug-13
		<QL	<QL	<QL	NULL	<QL	10-Sep-13
		<QL	<QL	<QL	NULL	<QL	10-Oct-13
		<QL	<QL	<QL	NULL	<QL	10-Nov-13
		<QL	<QL	<QL	NULL	<QL	10-Dec-13
		<QL	<QL	<QL	NULL	<QL	10-Jan-14
		<QL	<QL	<QL	NULL	<QL	10-Feb-14
		<QL	<QL	<QL	NULL	<QL	10-Mar-14
		<QL	<QL	<QL	NULL	<QL	10-Apr-14
		<QL	<QL	<QL	NULL	<QL	10-May-14
		<QL	<QL	<QL	NULL	<QL	10-Jun-14
		<QL	<QL	<QL	NULL	<QL	10-Jul-14
		<QL	<QL	<QL	NULL	<QL	10-Aug-14
		<QL	<QL	<QL	NULL	<QL	10-Sep-14
		<QL	<QL	<QL	NULL	<QL	10-Oct-14
		<QL	<QL	<QL	NULL	<QL	10-Nov-14
		<QL	<QL	<QL	NULL	<QL	10-Dec-14
		<QL	<QL	<QL	NULL	<QL	10-Jan-15
		<QL	<QL	<QL	NULL	<QL	10-Feb-15
		<QL	<QL	<QL	NULL	<QL	10-Mar-15
		<QL	<QL	<QL	NULL	<QL	10-Apr-15
		<QL	<QL	<QL	NULL	<QL	10-May-15
		<QL	<QL	<QL	NULL	<QL	10-Jun-15
		<QL	<QL	<QL	NULL	<QL	10-Jul-15

Outfall No.	Parameter	Quant Avg	Quanti Max	Conc Avg	Conc Min	Conc Max	Due Date
001	COPPER, TOTAL RECOVERABLE (ug/L)	NULL	NULL	3.9	NULL	3.9	10-Mar-12
		NULL	NULL	3.7	NULL	3.7	10-Apr-12
		NULL	NULL	5.3	NULL	5.3	10-May-12
		NULL	NULL	7.3	NULL	7.3	10-Jun-12
		NULL	NULL	10.3	NULL	10.3	10-Jul-12
		NULL	NULL	4.3	NULL	4.3	10-Aug-12
		NULL	NULL	2.6	NULL	2.6	10-Sep-12
		NULL	NULL	2.2	NULL	2.2	10-Oct-12
		NULL	NULL	2.4	NULL	2.4	10-Nov-12
		NULL	NULL	2.7	NULL	2.7	10-Dec-12
		NULL	NULL	4.0	NULL	4.0	10-Jan-13
		NULL	NULL	2.6	NULL	2.6	10-Feb-13
		NULL	NULL	2.0	NULL	2.0	10-Mar-13
		NULL	NULL	3.9	NULL	3.9	10-Apr-13
		NULL	NULL	2.1	NULL	2.1	10-May-13
		NULL	NULL	2.4	NULL	2.4	10-Jun-13
		NULL	NULL	3.9	NULL	3.9	10-Jul-13
		NULL	NULL	2.0	NULL	2.0	10-Aug-13
		NULL	NULL	2.9	NULL	2.9	10-Sep-13
		NULL	NULL	3.1	NULL	3.1	10-Oct-13
		NULL	NULL	2.8	NULL	2.8	10-Nov-13
		NULL	NULL	3.3	NULL	3.3	10-Dec-13
		NULL	NULL	1.6	NULL	1.6	10-Jan-14
		NULL	NULL	2.6	NULL	2.6	10-Feb-14
		NULL	NULL	2.1	NULL	2.1	10-Mar-14
		NULL	NULL	1.3	NULL	1.3	10-Apr-14
		NULL	NULL	1.9	NULL	1.9	10-May-14
		NULL	NULL	2.9	NULL	2.9	10-Jun-14
		NULL	NULL	14	NULL	14	10-Jul-14
		NULL	NULL	3.1	NULL	3.1	10-Aug-14
		NULL	NULL	5.9	NULL	5.9	10-Sep-14
		NULL	NULL	4.8	NULL	4.8	10-Oct-14
		NULL	NULL	8.3	NULL	8.3	10-Nov-14
		NULL	NULL	2.3	NULL	2.3	10-Dec-14
		NULL	NULL	2.0	NULL	2.0	10-Jan-15
		NULL	NULL	4.3	NULL	4.3	10-Feb-15
		NULL	NULL	1.4	NULL	1.4	10-Mar-15
		NULL	NULL	1.9	NULL	1.9	10-Apr-15
		NULL	NULL	2.5	NULL	2.5	10-May-15
		NULL	NULL	1.5	NULL	1.5	10-Jun-15
		NULL	NULL	2.7	NULL	2.7	10-Jul-15

Central Middlesex STP **VA0073318** **Effluent Data reported on 2015 Application**

PARAMETER	Maximum Daily Value		Average Daily Value		
	Value	Units	Value	Units	Number of Samples
pH (Minimum)	6.8	S.U.			
pH (Maximum)	8.8	S.U.			
Flow Rate	0.084	MGD	0.021	MGD	continuous
Temperature (Winter)	15	Celsius	12	Celsius	90
Temperature (Summer)	28	Celsius	26	Celsius	92

POLLUTANT	Maximum Daily Discharge		Average Daily Discharge		
	Conc.	Units	Conc.	Units	Number of Samples
$CBOD_5$	<2	mg/L	<2	mg/L	12
Fecal Coliform	3	N/100 ml	1	N/100 ml	52
TSS	5	mg/L	0.98	mg/L	12

Attachment E: 2012 Stream Sanitation Analysis

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office
4949-A Cox Road Glen Allen, Virginia 23060

SUBJECT: Stream Sanitation Analysis
Central Middlesex WWTP - VA0073318

TO: Jaime Bauer

FROM: Jennifer Palmore, P.G.

DATE: March 13, 2012

COPIES: Modeling File

The Central Middlesex sewage treatment plant (STP) is located in Middlesex County near Saluda, VA. The facility was previously named the Middle Peninsula Regional Security Center STP, however the facility was renamed when the Hampton Roads Sanitation District took over operation of the facility.

The current discharge was initially modeled by D.X. Ren on April 12, 1995 when the security center was requesting a permit modification to expand from 0.0099 MGD to 0.0395 MGD. Ren performed a site inspection and determined that the receiving stream flows approximately 0.80 mile before it enters an unmodelable swampy area. He modeled the stream from outfall to the swampy area and applied A.J. Anthony's March 9, 1987 memorandum "Advisory Notification of Effluent Limits for Swamp and Marsh Waters" at the model boundary. Therefore, the free-flowing portion of the stream had to maintain the minimum water quality standard of 5 mg/L dissolved oxygen (DO), and, when entering the swamp, contain no more than 10 mg/L $cBOD_5$ and 3 mg/L total Kjeldahl nitrogen (TKN). In order to meet those conditions, the facility was assigned effluent limits of 11.0 mg/L of $cBOD_5$, 3.0 mg/L of TKN, and 6.5 mg/L (minimum) of DO.

However, there is no record of a CTO for the facility, therefore HRSD conducted a capacity analysis and determined that the facility has only a 0.025 MGD capacity. Based on this, in November 2011, I was asked to re-run D.X. Ren's model using Regional Model 4.11 and the updated effluent flow. No site visit was performed. Only one significant change was made from the previous model. As the stream is expected to be 100% effluent during the modeled low-flow conditions, the 90th percentile effluent temperature of 28.5°C (as provided by the permit writer) was used.

HRSD expressed concern about the difference between the model results and the current permit limits; therefore the permit writer requested a model update. I performed a site visit with Jaime Bauer and Will Hundley (HRSD) on March 8, 2012. The receiving stream is an ephemeral stream that flows 0.35 mile and then joins an intermittent tributary which drains the east side of the security center. The intermittent stream then continues approximately 0.42 mile until it enters the swampy area. During the site visit, the streams were walked from the outfall to approximately 0.1 mile below the confluence. The ephemeral receiving stream has a significantly higher slope that flattens out considerably when it enters the intermittent stream. The model was therefore split into two segments.

Elevation data was obtained from the topographic map, channel characteristics and the stream

width were estimated based on the site visit, and stream depth and flow were calculated using Manning's equation. A default ambient stream temperature of 28°C was used and a 90th percentile effluent temperature of 28°C was calculated based on updated information provided by the permittee.

Based on the ephemeral/intermittent nature of the streams, both segments are considered Tier 1 waters. Modeling was performed to maintain the daily average dissolved oxygen water quality standard of 5.0 mg/L in both segments and to maintain the swamp-limits at the downstream boundary. The streams are expected to meet those modeling conditions if the following permit limits are applied:

Flow (Q)	0.025 MGD
cBOD$_5$	9 mg/L
TKN	3.0 mg/L
DO	6.3 mg/L

Copies of the model documentation are attached. If you have any questions or need any additional information, please let me know.

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to XCM - URBANNA CREEK, UT.

File Information

File Name:	C:\Documents and Settings\jvpalmore\My Documents\models\Reports\Ce
Date Modified:	March 13, 2012

Water Quality Standards Information

Stream Name:	XCM - URBANNA CREEK, UT
River Basin:	Rappahannock River Basin
Section:	2
Class:	III - Nontidal Waters (Coastal and Piedmont)
Special Standards:	none

Background Flow Information

Gauge Used:	#01669000 Piscataway Creek near Tappahannock, VA
Gauge Drainage Area:	28 Sq.Mi.
Gauge 7Q10 Flow:	0.32 MGD
Headwater Drainage Area:	0 Sq.Mi.
Headwater 7Q10 Flow:	0 MGD (Net; includes Withdrawals/Discharges)
Withdrawal/Discharges:	0 MGD
Incremental Flow in Segments:	1.142857E-02 MGD/Sq.Mi.

Background Water Quality

Background Temperature:	28 Degrees C
Background cBOD5:	2 mg/l
Background TKN:	0 mg/l
Background D.O.:	7.137288 mg/l

Model Segmentation

Number of Segments:	2
Model Start Elevation:	80 ft above MSL
Model End Elevation:	1.5 ft above MSL

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to XCM - URBANNA CREEK, UT.

Segment Information for Segment 1

Definition Information

Segment Definition:	A discharge enters.
Discharge Name:	HRSD - CENTRAL MIDDLESEX STP
VPDES Permit No.:	VA0073318

Discharger Flow Information

Flow:	0.025 MGD
cBOD5:	9 mg/l
TKN:	3 mg/l
D.O.:	6.3 mg/l
Temperature:	28 Degrees C

Geographic Information

Segment Length:	0.35 miles
Upstream Drainage Area:	0 Sq.Mi.
Downstream Drainage Area:	0.22 Sq.Mi.
Upstream Elevation:	80 Ft.
Downstream Elevation:	6 Ft.

Hydraulic Information

Segment Width:	1 Ft.
Segment Depth:	0.062 Ft.
Segment Velocity:	0.619 Ft./Sec.
Segment Flow:	0.025 MGD
Incremental Flow:	0.003 MGD (Applied at end of segment.)

Channel Information

Cross Section:	Deep Narrow U
Character:	Moderately Meandering
Pool and Riffle:	No
Bottom Type:	Sand
Sludge:	None
Plants:	None
Algae:	None

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to XCM - URBANNA CREEK, UT.

Segment Information for Segment 2

Definition Information

Segment Definition:	A significant change occurs.

Geographic Information

Segment Length:	0.42 miles
Upstream Drainage Area:	0.22 Sq.Mi.
Downstream Drainage Area:	0.94 Sq.Mi.
Upstream Elevation:	6 Ft.
Downstream Elevation:	1.5 Ft.

Hydraulic Information

Segment Width:	1.2 Ft.
Segment Depth:	0.109 Ft.
Segment Velocity:	0.219 Ft./Sec.
Segment Flow:	0.025 MGD
Incremental Flow:	0.008 MGD (Applied at end of segment.)

Channel Information

Cross Section:	Wide Shallow Arc
Character:	Moderately Meandering
Pool and Riffle:	No
Bottom Type:	Sand
Sludge:	None
Plants:	None
Algae:	None

"Model Run For C:\Documents and Settings\jvpalmore\My Documents\models\Reports\Central Middlesex\Central Middlesex model file.mod On 3/13/2012 2:32:15 PM"

"Model is for XCM - URBANNA CREEK, UT."
"Model starts at the HRSD - CENTRAL MIDDLESEX STP discharge."

"Background Data"
"7Q10", "cBOD5", "TKN", "DO", "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
0, 2, 0, 7.137, 28

"Discharge/Tributary Input Data for Segment 1"
"Flow", "cBOD5", "TKN", "DO", "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
.025, 9, 3, ,6.3, 28

"Hydraulic Information for Segment 1"
"Length","Width", "Depth", "Velocity"
"(mi)", "(ft)", "(ft)", "(ft/sec)"
.35, 1, .062, .619

"Initial Mix Values for Segment 1"
"Flow", "DO", "cBOD", "nBOD", "DOSat", "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
.025, 6.3, 22.5, 0, 7.941, 28

"Rate Constants for Segment 1. - (All units Per Day)"
"k1", "k1@T", "k2", "k2@T", "kn", "kn@T", "BD", "BD@T"
1.4, 2.022, 20, 24.179, .35, .648, 0, 0

"Output for Segment 1"
"Segment starts at HRSD - CENTRAL MIDDLESEX STP"
"Total", "Segm."
"Dist.", "Dist.", "DO", "cBOD", "nBOD"
"(mi)", "(mi)", "(mg/l)", "(mg/l)", "(mg/l)"
0, 0, 6.3, 22.5, 0
.1, .1, 6.253, 22.055, 0
.2, .2, 6.224, 21.619, 0
.3, .3, 6.209, 21.192, 0
.35, .35, 6.205, 20.982, 0

"Discharge/Tributary Input Data for Segment 2"
"Flow", "cBOD5", "TKN", "DO", "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
0, 0, 0, ,0, 0

"Incremental Flow Input Data for Segment 2"
"Flow", "cBOD5", "TKN", "DO", "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
.003, 2, 0, ,7.156, 28

"Hydraulic Information for Segment 2"
"Length","Width", "Depth", "Velocity"
"(mi)", "(ft)", "(ft)", "(ft/sec)"
.42, 1.2, .109, .219

"Initial Mix Values for Segment 2"
"Flow", "DO", "cBOD", "nBOD", "DOSat", "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"

```
.028,    6.307,    19.27,    0,        7.952,    28

"Rate Constants for Segment 2. - (All units Per Day)"
"k1",   "k1@T", "k2",    "k2@T", "kn",    "kn@T", "BD",    "BD@T"
1.2,    1.733,  6.429,   7.772,  .35,     .648,   0,       0

"Output for Segment 2"
"Segment starts at "
"Total", "Segm."
"Dist.", "Dist.",   "DO",      "cBOD",    "nBOD"
"(mi)",  "(mi)",    "(mg/l)", "(mg/l)", "(mg/l)"
.35,     0,         6.307,     19.27,     0
.45,     .1,        5.811,     18.36,     0
.55,     .2,        5.45,      17.493,    0
.65,     .3,        5.196,     16.667,    0
.75,     .4,        5.027,     15.88,     0
.77,     .42,       5.002,     15.727,    0


"END OF FILE"
```

Attachment F: VDH 1995 Comment of Fecal Coliform Limitation

COMMONWEALTH of VIRGINIA

DONALD R. STERN, M.D., M.P.H.
ACTING STATE HEALTH COMMISSIONER

Department of Health
Office of Water Programs

REPLY TO
EAST CENTRAL FIELD OFFICE
CLOVERLEAF OFFICE PARK
300 TURNER ROAD
RICHMOND, VIRGINIA 23225
PHONE: 674-2880; FAX 674-2815

SUBJECT: MIDDLESEX COUNTY
Sewerage - Middle Peninsula Regional
Security Center Expansion

26 September 1995

Ms. Debra J. Barnes, Environmental Engineer
Dept. of Environmental Quality
Water Division, Kilmarnock Office
P.O. Box 669
Kilmarnock, Virginia 22482

Dear Ms. Barnes:

This is pursuant to our discussion on 19 September 1995 and other previous discussions that followed the public hearing regarding issuance of the VPDES permit for the proposed expansion of the sewage treatment works (STW) which serves the Middle Peninsula Regional Security Center in Middlesex County. We have received plans from the engineer for the subject project which include the following in order to provide increased public health protection in the area downstream of the proposed dry ditch discharge:

1. The chlorine contact tank will have more than 60 minute detention time at an average design flow of 39,500 gpd to ensure optimum disinfection of the effluent.

2 A probe will be provided near the end of the chlorine contact tank which will monitor chlorine residual every 2 1/2 minutes and will energize an alarm whenever the chlorine residual drops below a set level. The alarm is actuated at the main control panel for the sewage treatment plant as well as the Jail Control Room, which is always manned 24 hours a day, 7 days a week.

3. The dechlorination process, although included in the plans presently submitted, will be eliminated so that the process of chlorine disinfection continues beyond the chlorine contact tank.

4. The effluent discharge point has been relocated so that the effluent will travel at least 500 feet before it leaves the property of the jail.

5. Four rock check dams will be installed between the point of discharge and the end of the jail property. The purpose of these dams is to maximize retention of the effluent on the jail property, thereby allowing time for additional die-off of pathogens remaining in the effluent and for infiltration of the effluent into the soil. The rock check dams should be designed to retard the flow so that a good portion of the effluent infiltrates into the ground at each dam. Wetland - type plants which are tolerant of shade should be planted in the drainage ditch adjacent to the check dams.

6. By letter dated 6 September 1995, we have previously requested that the VPDES effluent limit for fecal coliform be lowered from 200 N/100 ml to 20 N/100 ml, a ten(10) fold reduction.

Please incorporate the items pertinent to the VPDES permit in the final VPDES permit. If we can be of further assistance, please contact A. N. Mirza at (804) 674 - 2892.

Sincerely,

Randy Monisette

for W. S. Shaw, P.E.
Acting Engineering Field Director
East Central Environmental Engineering Field Office

cc: Mr. David Harmon, Middle Peninsula Regional Security Center
Department of Environmental Quality - Office of Engineering Applications
Middlesex County Health Department
Mr. Don Caskie, P.E., Caskie Engineering
VDH - DSS
VDH - Central Office, DWE

Attachment G: MSTRANTI source table and spreadsheet; STATS Outputs; WER Study Analysis

VA0073318– Central Middlesex STP

MSTRANTI DATA SOURCE REPORT

Stream Information:	
Mean Hardness	Due to its ephemeral nature of the receiving stream (See Attachment A), effluent data is used to characterize the stream at low-flow conditions.
90% Temperature	
90% Maximum pH	
10% Maximum pH	
Tier Designation	From Flow Frequency Memo (Attachment A)
Mixing Information:	
All Data	Due to its ephemeral nature of the receiving stream, 100% mixing is assumed.
Effluent Information:	
Mean Hardness	Conservative value of 25 mg/L was used
90% Temperature	From Effluent Data provided with the 2015 Application (Attachment D)
90% Maximum pH	Calculated from DMR Data (Attachment D)
10% Maximum pH	
Discharge Flow	From Application Form 2A

FRESHWATER
WATER QUALITY CRITERIA / WASTELOAD ALLOCATION ANALYSIS

Facility Name: Central Middlesex STP Permit No.: VA0073318

Receiving Stream: UT Urbanna Creek Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information			Stream Flows			Mixing Information			Effluent Information		
Mean Hardness (as CaCO3) =	25	mg/L	1Q10 (Annual) =	0	MGD	Annual - 1Q10 Mix =	100	%	Mean Hardness (as CaCO3) =	25	mg/L
90% Temperature (Annual) =	28	deg C	7Q10 (Annual) =	0	MGD	- 7Q10 Mix =		%	90% Temp (Annual) =	28	deg C
90% Temperature (Wet season) =		deg C	30Q10 (Annual) =	0	MGD	- 30Q10 Mix =		%	90% Temp (Wet season) =		deg C
90% Maximum pH =	8.8	SU	1Q10 (Wet season) =		MGD	Wet Season - 1Q10 Mix =		%	90% Maximum pH =	8.8	SU
10% Maximum pH =	8.4	SU	30Q10 (Wet season) =		MGD	- 30Q10 Mix =		%	10% Maximum pH =	8.4	SU
Tier Designation (1 or 2) =	1		30Q5 =	0	MGD				Discharge Flow =	0.025	MGD
Public Water Supply (PWS) Y/N? =	n		Harmonic Mean =	0	MGD						
Trout Present Y/N? =	n										
Early Life Stages Present Y/N? =	y										

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Acenapthene	0	--	--	na	9.9E+02	--	--	na	9.9E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.9E+02**
Acrolein	0	--	--	na	9.3E+00	--	--	na	9.3E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.3E+00**
Acrylonitrile [C]	0	--	--	na	2.5E+00	--	--	na	2.5E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.5E+00**
Aldrin [C]	0	3.0E+00	--	na	5.0E-04	3.0E+00	--	na	5.0E-04	--	--	--	--	--	--	--	--	**3.0E+00**	**--**	**na**	**5.0E-04**
Ammonia-N (mg/l) (Yearly)	0	1.84E+00	2.77E-01	na	--	1.84E+00	2.77E-01	na	--	--	--	--	--	--	--	--	--	**1.84E+00**	**2.77E-01**	**na**	**--**
Ammonia-N (mg/l) (High Flow)	0	1.84E+00	6.61E-01	na	--	1.84E+00	6.61E-01	na	--	--	--	--	--	--	--	--	--	**1.84E+00**	**6.61E-01**	**na**	**--**
Anthracene	0	--	--	na	4.0E+04	--	--	na	4.0E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.0E+04**
Antimony	0	--	--	na	6.4E+02	--	--	na	6.4E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.4E+02**
Arsenic	0	3.4E+02	1.5E+02	na	--	3.4E+02	1.5E+02	na	--	--	--	--	--	--	--	--	--	**3.4E+02**	**1.5E+02**	**na**	**--**
Barium	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Benzene [C]	0	--	--	na	5.1E+02	--	--	na	5.1E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.1E+02**
Benzidine [C]	0	--	--	na	2.0E-03	--	--	na	2.0E-03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.0E-03**
Benzo (a) anthracene [C]	0	--	--	na	1.8E-01	--	--	na	1.8E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E-01**
Benzo (b) fluoranthene [C]	0	--	--	na	1.8E-01	--	--	na	1.8E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E-01**
Benzo (k) fluoranthene [C]	0	--	--	na	1.8E-01	--	--	na	1.8E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E-01**
Benzo (a) pyrene [C]	0	--	--	na	1.8E-01	--	--	na	1.8E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E-01**
Bis2-Chloroethyl Ether [C]	0	--	--	na	5.3E+00	--	--	na	5.3E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.3E+00**
Bis2-Chloroisopropyl Ether	0	--	--	na	6.5E+04	--	--	na	6.5E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.5E+04**
Bis 2-Ethylhexyl Phthalate [C]	0	--	--	na	2.2E+01	--	--	na	2.2E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.2E+01**
Bromoform [C]	0	--	--	na	1.4E+03	--	--	na	1.4E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.4E+03**
Butylbenzylphthalate	0	--	--	na	1.9E+03	--	--	na	1.9E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.9E+03**
Cadmium	0	8.2E-01	3.8E-01	na	--	8.2E-01	3.8E-01	na	--	--	--	--	--	--	--	--	--	**8.2E-01**	**3.8E-01**	**na**	**--**
Carbon Tetrachloride [C]	0	--	--	na	1.6E+01	--	--	na	1.6E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.6E+01**
Chlordane [C]	0	2.4E+00	4.3E-03	na	8.1E-03	2.4E+00	4.3E-03	na	8.1E-03	--	--	--	--	--	--	--	--	**2.4E+00**	**4.3E-03**	**na**	**8.1E-03**
Chloride	0	8.6E+05	2.3E+05	na	--	8.6E+05	2.3E+05	na	--	--	--	--	--	--	--	--	--	**8.6E+05**	**2.3E+05**	**na**	**--**
TRC	0	1.9E+01	1.1E+01	na	--	1.9E+01	1.1E+01	na	--	--	--	--	--	--	--	--	--	**1.9E+01**	**1.1E+01**	**na**	**--**
Chlorobenzene	0	--	--	na	1.6E+03	--	--	na	1.6E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.6E+03**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Chlorodibromomethane [C]	0	--	--	na	1.3E+02	--	--	na	1.3E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+02**
Chloroform	0	--	--	na	1.1E+04	--	--	na	1.1E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+04**
2-Chloronaphthalene	0	--	--	na	1.6E+03	--	--	na	1.6E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.6E+03**
2-Chlorophenol	0	--	--	na	1.5E+02	--	--	na	1.5E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+02**
Chlorpyrifos	0	8.3E-02	4.1E-02	na	--	8.3E-02	4.1E-02	na	--	--	--	--	--	--	--	--	--	**8.3E-02**	**4.1E-02**	**na**	**--**
Chromium III	0	1.8E+02	2.4E+01	na	--	1.8E+02	2.4E+01	na	--	--	--	--	--	--	--	--	--	**1.8E+02**	**2.4E+01**	**na**	**--**
Chromium VI	0	1.6E+01	1.1E+01	na	--	1.6E+01	1.1E+01	na	--	--	--	--	--	--	--	--	--	**1.6E+01**	**1.1E+01**	**na**	**--**
Chromium, Total	0	--	--	1.0E+02	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Chrysene [C]	0	--	--	na	1.8E-02	--	--	na	1.8E-02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E-02**
Copper	0	3.6E+00	2.7E+00	na	--	3.6E+00	2.7E+00	na	--	--	--	--	--	--	--	--	--	**3.6E+00**	**2.7E+00**	**na**	**--**
Cyanide, Free	0	2.2E+01	5.2E+00	na	1.6E+04	2.2E+01	5.2E+00	na	1.6E+04	--	--	--	--	--	--	--	--	**2.2E+01**	**5.2E+00**	**na**	**1.6E+04**
DDD [C]	0	--	--	na	3.1E-03	--	--	na	3.1E-03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.1E-03**
DDE [C]	0	--	--	na	2.2E-03	--	--	na	2.2E-03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.2E-03**
DDT [C]	0	1.1E+00	1.0E-03	na	2.2E-03	1.1E+00	1.0E-03	na	2.2E-03	--	--	--	--	--	--	--	--	**1.1E+00**	**1.0E-03**	**na**	**2.2E-03**
Demeton	0	--	1.0E-01	na	--	--	1.0E-01	na	--	--	--	--	--	--	--	--	--	**--**	**1.0E-01**	**na**	**--**
Diazinon	0	1.7E-01	1.7E-01	na	--	1.7E-01	1.7E-01	na	--	--	--	--	--	--	--	--	--	**1.7E-01**	**1.7E-01**	**na**	**--**
Dibenz(a,h)anthracene [C]	0	--	--	na	1.8E-01	--	--	na	1.8E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E-01**
1,2-Dichlorobenzene	0	--	--	na	1.3E+03	--	--	na	1.3E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+03**
1,3-Dichlorobenzene	0	--	--	na	9.6E+02	--	--	na	9.6E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.6E+02**
1,4-Dichlorobenzene	0	--	--	na	1.9E+02	--	--	na	1.9E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.9E+02**
3,3-Dichlorobenzidine [C]	0	--	--	na	2.8E-01	--	--	na	2.8E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.8E-01**
Dichlorobromomethane [C]	0	--	--	na	1.7E+02	--	--	na	1.7E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.7E+02**
1,2-Dichloroethane [C]	0	--	--	na	3.7E+02	--	--	na	3.7E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.7E+02**
1,1-Dichloroethylene	0	--	--	na	7.1E+03	--	--	na	7.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.1E+03**
1,2-trans-dichloroethylene	0	--	--	na	1.0E+04	--	--	na	1.0E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.0E+04**
2,4-Dichlorophenol	0	--	--	na	2.9E+02	--	--	na	2.9E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.9E+02**
2,4-Dichlorophenoxy acetic acid (2,4-D)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
1,2-Dichloropropane [C]	0	--	--	na	1.5E+02	--	--	na	1.5E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+02**
1,3-Dichloropropene [C]	0	--	--	na	2.1E+02	--	--	na	2.1E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.1E+02**
Dieldrin [C]	0	2.4E-01	5.6E-02	na	5.4E-04	2.4E-01	5.6E-02	na	5.4E-04	--	--	--	--	--	--	--	--	**2.4E-01**	**5.6E-02**	**na**	**5.4E-04**
Diethyl Phthalate	0	--	--	na	4.4E+04	--	--	na	4.4E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.4E+04**
2,4-Dimethylphenol	0	--	--	na	8.5E+02	--	--	na	8.5E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.5E+02**
Dimethyl Phthalate	0	--	--	na	1.1E+06	--	--	na	1.1E+06	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+06**
Di-n-Butyl Phthalate	0	--	--	na	4.5E+03	--	--	na	4.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.5E+03**
2,4 Dinitrophenol	0	--	--	na	5.3E+03	--	--	na	5.3E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.3E+03**
2-Methyl-4,6-Dinitrophenol	0	--	--	na	2.8E+02	--	--	na	2.8E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.8E+02**
2,4-Dinitrotoluene [C]	0	--	--	na	3.4E+01	--	--	na	3.4E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.4E+01**
Dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin	0	--	--	na	5.1E-08	--	--	na	5.1E-08	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.1E-08**
1,2-Diphenylhydrazine [C]	0	--	--	na	2.0E+00	--	--	na	2.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.0E+00**
Alpha-Endosulfan	0	2.2E-01	5.6E-02	na	8.9E+01	2.2E-01	5.6E-02	na	8.9E+01	--	--	--	--	--	--	--	--	**2.2E-01**	**5.6E-02**	**na**	**8.9E+01**
Beta-Endosulfan	0	2.2E-01	5.6E-02	na	8.9E+01	2.2E-01	5.6E-02	na	8.9E+01	--	--	--	--	--	--	--	--	**2.2E-01**	**5.6E-02**	**na**	**8.9E+01**
Alpha + Beta Endosulfan	0	2.2E-01	5.6E-02	--	--	2.2E-01	5.6E-02	--	--	--	--	--	--	--	--	--	--	**2.2E-01**	**5.6E-02**	**--**	**--**
Endosulfan Sulfate	0	--	--	na	8.9E+01	--	--	na	8.9E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.9E+01**
Endrin	0	8.6E-02	3.6E-02	na	6.0E-02	8.6E-02	3.6E-02	na	6.0E-02	--	--	--	--	--	--	--	--	**8.6E-02**	**3.6E-02**	**na**	**6.0E-02**
Endrin Aldehyde	0	--	--	na	3.0E-01	--	--	na	3.0E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.0E-01**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Ethylbenzene	0	--	--	na	2.1E+03	--	--	na	2.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.1E+03**
Fluoranthene	0	--	--	na	1.4E+02	--	--	na	1.4E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.4E+02**
Fluorene	0	--	--	na	5.3E+03	--	--	na	5.3E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.3E+03**
Foaming Agents	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Guthion	0	--	1.0E-02	na	--	--	1.0E-02	na	--	--	--	--	--	--	--	--	--	**--**	**1.0E-02**	**na**	**--**
Heptachlor [C]	0	5.2E-01	3.8E-03	na	7.9E-04	5.2E-01	3.8E-03	na	7.9E-04	--	--	--	--	--	--	--	--	**5.2E-01**	**3.8E-03**	**na**	**7.9E-04**
Heptachlor Epoxide[C]	0	5.2E-01	3.8E-03	na	3.9E-04	5.2E-01	3.8E-03	na	3.9E-04	--	--	--	--	--	--	--	--	**5.2E-01**	**3.8E-03**	**na**	**3.9E-04**
Hexachlorobenzene[C]	0	--	--	na	2.9E-03	--	--	na	2.9E-03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.9E-03**
Hexachlorobutadiene[C]	0	--	--	na	1.8E+02	--	--	na	1.8E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E+02**
Hexachlorocyclohexane Alpha-BHC[C]	0	--	--	na	4.9E-02	--	--	na	4.9E-02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.9E-02**
Hexachlorocyclohexane Beta-BHC[C]	0	--	--	na	1.7E-01	--	--	na	1.7E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.7E-01**
Hexachlorocyclohexane Gamma-BHC[C] (Lindane)	0	9.5E-01	na	na	1.8E+00	9.5E-01	--	na	1.8E+00	--	--	--	--	--	--	--	--	**9.5E-01**	**--**	**na**	**1.8E+00**
Hexachlorocyclopentadiene	0	--	--	na	1.1E+03	--	--	na	1.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+03**
Hexachloroethane[C]	0	--	--	na	3.3E+01	--	--	na	3.3E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.3E+01**
Hydrogen Sulfide	0	--	2.0E+00	na	--	--	2.0E+00	na	--	--	--	--	--	--	--	--	--	**--**	**2.0E+00**	**na**	**--**
Indeno (1,2,3-cd) pyrene [C]	0	--	--	na	1.8E-01	--	--	na	1.8E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E-01**
Iron	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Isophorone[C]	0	--	--	na	9.6E+03	--	--	na	9.6E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.6E+03**
Kepone	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	**--**	**0.0E+00**	**na**	**--**
Lead	0	2.0E+01	2.3E+00	na	--	2.0E+01	2.3E+00	na	--	--	--	--	--	--	--	--	--	**2.0E+01**	**2.3E+00**	**na**	**--**
Malathion	0	--	1.0E-01	na	--	--	1.0E-01	na	--	--	--	--	--	--	--	--	--	**--**	**1.0E-01**	**na**	**--**
Manganese	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Mercury	0	1.4E+00	7.7E-01	- -	- -	1.4E+00	7.7E-01	- -	- -	--	--	--	--	--	--	--	--	**1.4E+00**	**7.7E-01**	**- -**	**- -**
Methyl Bromide	0	--	--	na	1.5E+03	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+03**
Methylene Chloride [C]	0	--	--	na	5.9E+03	--	--	na	5.9E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.9E+03**
Methoxychlor	0	--	3.0E-02	na	--	--	3.0E-02	na	--	--	--	--	--	--	--	--	--	**--**	**3.0E-02**	**na**	**--**
Mirex	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	**--**	**0.0E+00**	**na**	**--**
Nickel	0	5.6E+01	6.3E+00	na	4.6E+03	5.6E+01	6.3E+00	na	4.6E+03	--	--	--	--	--	--	--	--	**5.6E+01**	**6.3E+00**	**na**	**4.6E+03**
Nitrate (as N)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Nitrobenzene	0	--	--	na	6.9E+02	--	--	na	6.9E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.9E+02**
N-Nitrosodimethylamine[C]	0	--	--	na	3.0E+01	--	--	na	3.0E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.0E+01**
N-Nitrosodiphenylamine[C]	0	--	--	na	6.0E+01	--	--	na	6.0E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.0E+01**
N-Nitrosodi-n-propylamine[C]	0	--	--	na	5.1E+00	--	--	na	5.1E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.1E+00**
Nonylphenol	0	2.8E+01	6.6E+00	--	--	2.8E+01	6.6E+00	na	--	--	--	--	--	--	--	--	--	**2.8E+01**	**6.6E+00**	**na**	**--**
Parathion	0	6.5E-02	1.3E-02	na	--	6.5E-02	1.3E-02	na	--	--	--	--	--	--	--	--	--	**6.5E-02**	**1.3E-02**	**na**	**--**
PCB Total[C]	0	--	1.4E-02	na	6.4E-04	--	1.4E-02	na	6.4E-04	--	--	--	--	--	--	--	--	**--**	**1.4E-02**	**na**	**6.4E-04**
Pentachlorophenol [C]	0	3.6E+01	2.7E+01	na	3.0E+01	3.6E+01	2.7E+01	na	3.0E+01	--	--	--	--	--	--	--	--	**3.6E+01**	**2.7E+01**	**na**	**3.0E+01**
Phenol	0	--	--	na	8.6E+05	--	--	na	8.6E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.6E+05**
Pyrene	0	--	--	na	4.0E+03	--	--	na	4.0E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.0E+03**
Radionuclides	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Gross Alpha Activity (pCi/L)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Beta and Photon Activity (mrem/yr)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Radium 226 + 228 (pCi/L)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Uranium (ug/l)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Selenium, Total Recoverable	0	2.0E+01	5.0E+00	na	4.2E+03	2.0E+01	5.0E+00	na	4.2E+03	--	--	--	--	--	--	--	--	**2.0E+01**	**5.0E+00**	**na**	**4.2E+03**
Silver	0	3.2E-01	--	na	--	3.2E-01	--	na	--	--	--	--	--	--	--	--	--	**3.2E-01**	**--**	**na**	**--**
Sulfate	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
1,1,2,2-Tetrachloroethane[C]	0	--	--	na	4.0E+01	--	--	na	4.0E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.0E+01**
Tetrachloroethylene[C]	0	--	--	na	3.3E+01	--	--	na	3.3E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.3E+01**
Thallium	0	--	--	na	4.7E-01	--	--	na	4.7E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.7E-01**
Toluene	0	--	--	na	6.0E+03	--	--	na	6.0E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.0E+03**
Total dissolved solids	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Toxaphene [C]	0	7.3E-01	2.0E-04	na	2.8E-03	7.3E-01	2.0E-04	na	2.8E-03	--	--	--	--	--	--	--	--	**7.3E-01**	**2.0E-04**	**na**	**2.8E-03**
Tributyltin	0	4.6E-01	7.2E-02	na	--	4.6E-01	7.2E-02	na	--	--	--	--	--	--	--	--	--	**4.6E-01**	**7.2E-02**	**na**	**--**
1,2,4-Trichlorobenzene	0	--	--	na	7.0E+01	--	--	na	7.0E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.0E+01**
1,1,2-Trichloroethane[C]	0	--	--	na	1.6E+02	--	--	na	1.6E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.6E+02**
Trichloroethylene [C]	0	--	--	na	3.0E+02	--	--	na	3.0E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.0E+02**
2,4,6-Trichlorophenol [C]	0	--	--	na	2.4E+01	--	--	na	2.4E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.4E+01**
2-(2,4,5-Trichlorophenoxy) propionic acid (Silvex)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Vinyl Chloride[C]	0	--	--	na	2.4E+01	--	--	na	2.4E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.4E+01**
Zinc	0	3.6E+01	3.6E+01	na	2.6E+04	3.6E+01	3.6E+01	na	2.6E+04	--	--	--	--	--	--	--	--	**3.6E+01**	**3.6E+01**	**na**	**2.6E+04**

Notes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise
2. Discharge flow is highest monthly average or Form 2C maximum for Industries and design flow for Municipals
3. Metals measured as Dissolved, unless specified otherwise
4. "C" indicates a carcinogenic parameter
5. Regular WLAs are mass balances (minus background concentration) using the % of stream flow entered above under Mixing Information.
   Antidegradation WLAs are based upon a complete mix.
6. Antideg. Baseline = (0.25(WQC - background conc.) + background conc.) for acute and chronic
   = (0.1(WQC - background conc.) + background conc.) for human health
7. WLAs established at the following stream flows: 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens and Harmonic Mean for Carcinogens. To apply mixing ratios from a model set the stream flow equal to (mixing ratio - 1), effluent flow equal to 1 and 100% mix.

Metal	Target Value (SSTV)
Antimony	6.4E+02
Arsenic	9.0E+01
Barium	na
Cadmium	2.3E-01
Chromium III	1.4E+01
Chromium VI	6.4E+00
Copper	1.5E+00
Iron	na
Lead	1.4E+00
Manganese	na
Mercury	4.6E-01
Nickel	3.8E+00
Selenium	3.0E+00
Silver	1.3E-01
Zinc	1.4E+01

Note: do not use QL's lower than the minimum QL's provided in agency guidance

Central Middlesex STP VA0073318 STATS.exe

Chemical = **Ammonia (mg/L)**
Chronic averaging period = 30
WLAa = 1.84
WLAc = 0.277
Q.L. = 0.2
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 3
Variance = 3.24
C.V. = 0.6
97th percentile daily values = 7.30025
97th percentile 4 day average = 4.99137
97th percentile 30 day average= 3.61815
< Q.L. = 0

Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 0.558894615876318
Average Weekly limit = 0.558894615876318
Average Monthly LImit = 0.558894615876318

The data are:

3 mg/L

Chemical = **Copper (ug/L)**
Chronic averaging period = 4
WLAa = 104
WLAc = 79
Q.L. = 0.5
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 47
Expected Value = 3.60263
Variance = 4.65642
C.V. = 0.598972
97th percentile daily values = 8.7571
97th percentile 4 day average = 5.98943
97th percentile 30 day average= 4.34369
< Q.L. = 0

Model used = lognormal

No Limit is required for this material

The data are (ug/L):

3.9	2.8
3.7	3.3
5.3	1.6
7.3	2.6
10.3	2.1
4.3	1.3
2.6	1.9
2.2	2.9
2.4	14
2.7	3.1
4.0	5.9
2.6	4.8
2.0	8.3
3.9	2.3
2.1	2.0
2.4	4.3
3.9	1.4
2.0	
2.9	
3.1	
2.8	
3.3	
1.6	
2.6	
2.1	
1.3	
1.9	
2.9	
14	

ACUTE CALCS

Criteria Calculation ACUTE

WER	*e*	ln(hardness)
28.68	2.7183	3.2189

Effluent hardness	25
Stream hardness	0
Effluent flow	0.025
Stream flow 1Q10	0
Effluent %	100.0
Stream %	0.0

Acute Hardness	**Criteria$_a$**
25	**104.40**

WLA acute

Criteria * Q $_{total}$	Background	WLA$_a$	*JB*
2.609929917	0	104.3971967	104

CHRONIC CALCS

Criteria Calculation CHRONIC

WER	*e*	ln(hardness)
28.68	2.7183	3.2189

Effluent hardness	25
Stream hardness	0
Effluent flow	0.025
Stream flow 7Q10	0
Effluent %	100.0
Stream %	0.0

Chronic Hardness	**Criteria$_c$**
25	**78.56**

WLA chronic

Criteria * Q $_{total}$	Background	WLA$_c$	*JB*
1.96408789	0	78.5635156	79

Water Quality Criteria calculations are taken from Virginia Water Quality Standards, 9VAC25-260-140.

Attachment H: WER Study and DEQ Review and Approval

DEPARTMENT OF ENVIRONMENTAL QUALITY

SUBJECT: **Review of Central Middlesex STP, Virginia STP Water Effect Ratio Study (VPDES Permit # VA0073318)**

By: Alex M. Barron

Date: November 5, 2014

Summary Finding:
The Central Middlesex STP, Inc, located in Saluda, Virginia is a small wastewater treatment plant treating domestic sewage (0.025 MGD). .
The facility is operated by Hampton Roads Sanitation District (HRSD). They conducted a water effect ratio (WER) study following EPA's guidelines for a streamlined copper WER study under suitable conditions and resulted in acceptable date that supports establishing a **WER of 28.68** (applied to total copper measurements). This WER of 28.68 can be used in applying the Virginia water quality criteria for copper to the specific discharge conditions at the sewage treatment plant (STP) site. The WER can be used to adjust the Virginia acute and chronic criteria for copper and calculate the resulting waste load allocations (WLA) for this permit and will be used to make permit decisions for the need for copper discharge limits for the Central Middlesex STP, permit #VA0073318.

Description of study and review:
The Central Middlesex STP is a Wastewater Treatment Plant operated by HRSD, treating domestic sewage from a regional jail facility housing approximately 220 individuals. Treatment consists of flow equalization, sequence batch reactors, aeration, clarification, sand filter, UV disinfection, sludge wasting, holding chamber and the final effluent is discharged into a dry ditch which drains into an unnamed intermittent stream which has a 7Q10 flow of 0.0 MGD at the discharge site. This is a tributary to Urbanna Creek in the estuarine portion of the Rappahannock River basin.

A streamlined copper-water effect ratio (WER) study was conducted for the Central Middlesex STP in order to establish a WER that can be applied to the Virginian copper criteria equations to calculate copper criteria that would apply to the discharge from their sewage treatment plant (STP). Establishing a WER is an option allowed for by Virginia water quality criteria for most metals, including copper.

Virginia's water quality criteria for copper in freshwater consists of formulas to adjust the acute or chronic criteria for hardness using formulas developed and recommended by the U.S Environmental Protection Agency (EPA). The Virginia criteria formulas include a water effect ratio (WER) which is set at a default value of 1.0 unless a WER study is performed for a specific receiving stream and discharge to establish a WER for that receiving stream. The Central Middlesex STP conducted the WER study in order to establish a WER applicable to their STP's receiving stream and to their discharge permit.

The Virginia freshwater criteria formulas for copper are shown below.
Freshwater acute criterion (µg /l) = WER x $[_e\{0.9422[\ln(\text{hardness})]-1.700\}]$ x (CFa)

Freshwater chronic criterion (µg/l) = WER x $[_e\{0.8545[\ln(\text{hardness})]-1.702\}]$ x (CFc)

WER = Water Effect Ratio =1 unless shown otherwise under 9 VAC 25-260-140.F
e = natural antilogarithm
ln=natural logarithm
CFa = 0.960
CFc = 0.960

Central Middlesex WER Study:
The Central Middlesex STP conducted a water effect ratio (WER) study for copper in order to establish a WER that can be applied to the Virginian copper criteria equations to calculate copper criteria that would apply to the specific conditions in the receiving stream and to their discharge permit. This study followed the EPA guidance for a Streamlined Water-Effect Ratio Procedure for Discharges of Copper EPA-822-R-01-05 (hereafter referred to as the streamlined WER guidance). This guidance document is available at: http://epa.gov/waterscience/criteria/copper/2003/index.htm.

This streamlined WER guidance requires two sets of side-by-side copper-toxicity tests, conducted at least a month apart. Each WER test consists of two side-by-side toxicity tests, consisting of a lab–water test and a site-water test using a representative sample of the effluent and stream water mix at permit conditions, and where the test species *Ceriodaphnia dubia* is exposed to varying concentrations of added copper to establish an EC_{50} value for copper. One of the tests is conducted in clean laboratory water and another text is conducted in simulated stream water consisting of receiving stream water and effluent mixed at the conditions of the permit. The final effluent is discharged into a dry ditch which drains into an unnamed intermittent stream which has a 7Q10 flow of 0.0 MGD at the discharge site, so the simulated stream water consisted of 100% effluent. The two EC_{50} values for these two toxicity tests are used to calculate a water effect ratio by dividing the EC_{50} value from the test with the simulated stream-water by the EC_{50} value from the lab-water test. It is expected that STP discharges and/or natural waters will contain elevated levels of carbon and other suspended solids, which will absorb or bind with some of the copper and make it less toxic as compared to clean lab water. This should result in less toxicity of copper in the natural water and the WER allows us to establish the amount of adjustment that can be made to the standard default criteria calculations and adjusts the criteria to the specific conditions at the permitted discharge.

A review of the streamlined water effect ratio (WER) study performed by EA Engineering Ecotoxicology Laboratory in Hunt Valley, MD for the Central Middlesex STP indicates that the set of toxicity tests conducted in August and September 2013 were conducted under acceptable conditions and provide data that are suitable for establishing a WER for this permitted facility. In all tests, the testing laboratory measured the concentrations of copper in the toxicity tests and calculated EC_{50} values using acceptable and established methods based on total copper measurements. This allows for the calculation of a WER that is applicable to total copper measurements and which can be used directly for establishing permit limits for copper that are unique to this permit.

A Change Is Needed in Calculating the Water Effect Ratios:
The original report calculated WERs of >54.9 for the August test and 48.3 for the September test with a geometric mean of 51.5. However, these WERs have to be recalculated to follow the requirements of EPA's Streamlined Water-Effect Ratio Procedure for Discharges of Copper, which specifies under section G (Calculating and Interpreting Results). Under section 3.c.on page 13 the EPA guidance states;" if the hardness normalized EC50 in the laboratory water is less than the documented SMAV for the species, then use the SMAV in place of the laboratory water EC50 in the denominator of the WER". Appendix B page 17 provides SMAVs for *Ceriodaphnia dubia and Daphnia magna,* the as well as an equation for adjusting the SMAV to different hardness levels. The SMAV is the species mean acute value which is the mean of all the EC_{50} values for that species that were used in the calculation of the copper water quality criteria. The use of the SMAV maintains a direct connection to the level of sensitivity that species has in relation to the original criteria document and the level of protection intended by the water quality criteria.

The August lab water EC_{50} value was 1.95 µg/L at a hardness of 20 mg/L and the copper SMAV for *Ceriodaphnia dubia* normalized to a hardness of 20 is 5.268. The September lab water EC_{50} value was 2.73 µg/L at a hardness of 12 mg/L and the SMAV for *Ceriodaphnia dubia* normalized to the same hardness is 3.255 µg/L. In both instances, the lab water EC_{50} value was less than the hardness normalized SMAV, so these WERs must be recalculated using the SMAV normalized to the hardness of the effluent tests.

The August effluent test produced an EC_{50} value of >107 µg/L at a hardness of 20 mg/L and the SMAV for *Ceriodaphnia dubia* normalized to the same hardness is 5.268; producing a WER of 107/5.268 = 20.31.

The September effluent test produced an EC_{50} value of 131.8 µg/L at a hardness of 12 mg/L and the SMAV for *Ceriodaphnia dubia* normalized to the same hardness is 3.255; producing a WER of 131.8/3.255 = 40.49. The final WER is the geometric mean of these two values which is **28.68**. These adjustments are summarized below in Table 1.

The reason EPA's guidance requires the use of the SMAV in place of the lab-water EC_{50} value in this situation is that many of today's laboratory tests are conducted using very pure, deionized water which is much cleaner water than those typically used in the original toxicity tests that are the basis for the water quality criteria. The toxicity tests that form the dataset for the copper criteria are from tests using relatively clean natural waters, but which did contain small amounts of organic carbon and other dissolved materials that bound some portion of the copper and made it less toxic. In other words, the water quality criteria are based on assuming that the receiving water is clean, natural water and there is some background amount copper-binding capacity in the water. The extra pure waters used in many of today's laboratories have very little dissolved carbon as well as low conductivity and alkalinity or other characteristics that could lower the toxicity of copper. This often results in toxicity tests in these very pure lab water producing artificially low EC_{50} values. That is, cooper appears to be more toxic in these pure water tests compared to the natural water tests that are the basis for the water quality criteria. If the EC_{50} value produced in ultra clean water is unnaturally low, a WER calculated from the extra low lab water EC50 value will produce an artificially high WER and could result in an under-protective WER–modified criterion concentration. To maintain the appropriate level of protection; when a WER study's lab water EC_{50} value is lower than the SMAV for the test species (adjusted to the same hardness level), EPA requires that the test species' SMAV (normalized to the same hardness as the effluent test) must be used to calculate the WER in order to maintain proper relationship to the original criterion calculation.

I have made the necessary adjustments and recalculated the WERs as described below.

Recalculated Water Effect Ratios:
In Appendix B on page 17 of EPA's Streamlined WER Guidance provides the SMAV of *Ceriodaphnia dubia* at a hardness of 100 as 24.00 total copper. The *Ceriodaphnia dubia* SMAV can be normalized to the site water hardness by using the formula;

$$SMAV_{\text{at Site Hardness}} = SMAV_{\text{at hardness 100}} \text{ X } (\text{site hardness}/100)^{0.9422}$$

The hardness of the August site-water test was 20, so the Ceriodaphnia *dubia* SMAV normalized to a hardness of 20 is;

$$SMAV_{\text{at Site Hardness 20}} = 24.00 \text{ µg/L X } (20/100)^{0.9422} = 24.00 \text{ µg/L X } (0.20)^{0.9422}$$
$$= 24.00 \text{ µg/L X } 0.2195$$

$SMAV_{\text{at Site Hardness 20}}$ = 5.268 µg/L

.

In the August WER tests, the site- water test produced an EC_{50} value of > 107 µg/L and a lab-water test produced an EC_{50} value of 1.95 µg/L, both at a hardness of 20, while the SMAV for *Ceriodaphnia dubia* normalized to the same hardness is 5.268 µg/L. Because the August lab-water test EC_{50} value is less than the SMAV for *Ceriodaphnia dubia* normalized to the same hardness, the SMAV is used to calculate the WER; Site–water EC_{50} >107 / 5.268 = **20.31 WER for August**.

With the September WER tests, the site-water test produced an EC_{50} value of 131.8 µg/L and a lab-water test produced an EC_{50} value of 2.73 µg/L, both at a hardness of 12 of, while the SMAV for *Ceriodaphnia dubia* normalized to the same hardness is 3.255 µg/L. Because the August lab-water test EC_{50} value is less than the SMAV for *Ceriodaphnia dubia* normalized to the same hardness, the SMAV is used to calculate the WER; Site–water EC_{50} 131.8 / 3.255 = **40.49 WER for September.**

The original EC_{50} values from the two tests from August and September, as well as the SMAV values after being normalized to the hardness level corresponding to the site-water toxicity tests and the resulting WERs are shown in Table 1 attached below.

The final WER for this discharge site is the geometric mean of these two WERs;
Square root of 20.31 x 40.49 = **28.68 Final WER**

The geometric mean of these two values is the **Final WER = 28.68**.

This WER is higher than other WERs established in other STP-effluent-dominated streams where WERs have ranged from 2.593 to 15.7, but it is supported by the study results.

This WER of 28.68 can be used to adjust the Virginia copper criteria for purposes of assessing the need for total recoverable copper permit limits for the River Ridge, Virginia waste water treatment plant as it discharges into the unnamed dry ditch which leads to Little Bluestone Creek. This WER is unitless and is multiplied by Virginia copper criteria (as adjusted to the hardness level appropriate for this permit) to adjust the criteria to account for the local water characteristics at the site of this permitted discharge. The permit specific copper criteria for this discharge become;

Freshwater acute criterion (µg /l) = 28.68 x $[_e\{0.9422[\ln(\text{hardness})]-1.700\}]$ x 0.960

Freshwater chronic criterion (µg/l) = 28.68 x $[_e\{0.8545[\ln(\text{hardness})]-1.702\}]$ x 0.960

The WER can be used with any hardness that is considered appropriate for the Central Middlesex STP effluent without any need for any adjustments. Once a WER is calculated based on a site-water EC_{50} value and SMAV concentration normalized to equal hardness levels, the WER value is the same regardless of the hardness used in calculating a criterion value. It is simply a unitless adjustment factor in the criterion equation.

DEQ Review and Approval of WER by DEQ:
The Virginia Department of Environmental Quality's Water Quality Standards Unit has reviewed this study and **approves the use of a total copper WER of 28.68** to adjust the copper criteria as it applies to the Central Middlesex STP's permit and receiving stream, an unnamed intermittent stream which is a tributary to Urbanna Creek. This total copper WER of will be used to adjust the copper criteria and calculate the resulting waste load allocations (WLA) for this permit and will be used to make permit decisions for the need for copper discharge limits for the Central Middlesex STP.

WER public participation and application in permits procedure:
The Virginia water Quality Standards (WQS) allow for a permittee to demonstrate that a WER is appropriate for their discharge and receiving stream. The WQS Regulation at 9VAC 25-260-140.F.4 states that the WER shall be subject to the public participation requirements of the Permit Regulation and described in the public notice of the permit proceedings. DEQ action to approve or disapprove a WER applicable to a permittee is a case decision rather than an amendment to the WQS. Decisions regarding WERs are subject to the public participation requirements of the Permit Regulation. In the past, the U.S. Environmental Protection Agency (EPA) technically viewed a WER as a site-specific criterion. However, because Virginia has incorporated the allowance for a WER in the Water Quality Standards regulation as part of the formula for the copper criteria, and because EPA has approved this form of the criteria, EPA does not have to (and will not) officially approve each individual WER, but they require that that the public be given the opportunity to comment on the use of the WER in a permit.

As long as the WER is the established following EPA and DEQ recommended protocols (as is the case for the Central Middlesex STP) and the study has been reviewed and approved by DEQ, the WER can be considered scientifically valid and can be used to apply the Virginia criteria for copper in an individual permit. DEQ will supply copies of the WER study and the review materials to EPA as a courtesy to keep them informed, but EPA does not have a need to officially approve individual WERs.

Public Participation and Review:
To satisfy the public participation requirements and give the public the opportunity to comment on the WER, the WER-modified copper criteria can be subjected to public participations via a permit related comment period, either via a permit re-issuance or permit modification.

In Summary, Final WER:
The final WER to be used to calculate total copper permit limits for the Central Middlesex STP is **28.68.**

Table 1;

Summary of all EC_{50} values from the Central Middlesex STP WER studies; showing lab water values and SMAVs normalized to a standard hardness equal to the simulated stream's test hardness...

Test Description		**EC50 (total copper)**		**EC50 (total copper) (Normalized to hardness of simulated stream test)**
August 2013; Lab water (hardness 20 mg/L)		**1.95 µg/L**		**1.95 µg/L**
August 2013; (hardness 20 mg/L) simulated stream water test		**>107 µg/L**		**>107 µg/L**
***Ceriodaphnia. dubia* SMAV at hardness 50 = 12.49 µg/L normalized to hardness of effluent test: (see EPA Cu-WER Guidance, page 17)**			**Total Cu *C. dubia* SMAV (Normalized to hardness 20 mg/L)**	**5.268 µg/L**
September, 2013; Lab water (hardness = 12 mg/L)		**2.73 µg/L**		**2.73µg/L**
September, 2013; (hardness = 12 mg/L) simulated stream water test		**131.8 µg/L**		**131.8 µg/L**
***Ceriodaphnia. dubia* SMAV at hardness 50 = 12.49 µg/L normalized to hardness of effluent test: (see EPA Cu-WER Guidance, page 17)**			**Total Cu *C. dubia* SMAV (Normalized to hardness 12 mg/L)**	**3.255 µg/L**
WERs:		**Total Cu WER**		
August 2013 WER (using SMAV normalized to hardness @ 20 mg/L)	**>107 µg/L / 5.268 µg/L**	**= 20.31**		
September 2013 WER (using SMAV normalized to hardness @ 12 mg/L)	**131.8 µg/L / 3.255 µg/L**	**= 40.49**		
		Final WER (total copper)		
Final WER (geometric mean of both WERs)	$\sqrt{(20.31 \times 40.49)}$	**28.68**		

21 December 2012

Alex Barron
Virginia Department of Environmental Quality
629 East Main Street
P.O. Box 1105
Richmond, VA 23218

RE: Central Middlesex (VPDES# VA0073318) Water Effects Ratio Preliminary Plan of Study

Mr. Alex Barron,

Enclosed please find the preliminary plan of study for the Central Middlesex Sewage Treatment Plant (VPDES# VA0073318) water effects ratio (WER). Briefly, this WER will be implemented by HRSD and EA Engineering, Science and Technology, Inc. (Hunt Valley, MD). The attached proposed plan of study was designed using information from the VA DEQ "Water Effect Ratio (WER) Study Review Checklist", EPA document 822-R-01-005 ("Streamlined Water-Effect Ratio Procedure for Discharges of Copper"), and comments from the staff of EA Engineering. HRSD is submitting this preliminary WER plan of study for review and comment solicitation by VA DEQ. It is HRSD's intention once the WER study plan has been reviewed and finalized by VA DEQ to begin the WER study at Central Middlesex.

Sincerely,

Chris Burbage

Chris Burbage, PhD
Environmental Scientist
Water Quality-Technical Services Division
757-355-5013 (office)
757-318-6452 (fax)
Hampton Roads Sanitation District
1436 Air Rail Ave.
Virginia Beach, VA 23455

Introduction:

The Central Middlesex STP (CM), located in Saluda, VA (Middlesex Co.), is operated by Hampton Roads Sanitation District (HRSD). CM is a small community treatment plant (0.025 MGD) that services a regional jail facility supporting a population of approximately 220 individuals. The CM treatment facility maintains a treatment process consisting of flow equalization, sequence batch reactors, aeration, clarification, sand filter, UV disinfection, sludge wasting, and a holding chamber. CM is located in the Rappahannock River Basin and discharges into a dry ditch which drains to an intermittent stream that is an unnamed tributary to Urbanna Creek. HRSD has a discharge permit (VPDES Number VA0073318) which was issued 1/15/2012 (expiration date: 12/31/16). A four year schedule of compliance for a new copper limitation was included in the permit. The current total recoverable copper limitations for CM are set at a monthly and weekly average of 3.3 µg/L. Based on recent data, CM may not be able to consistently meet these challenging copper limits. Therefore, HRSD is examining the possibility of developing a site specific alternative criterion for copper using the Water Effect Ratio (WER) approach as allowed by EPA (1994) and the Commonwealth of Virginia (9 VAC 25-260, January 2006).

The Commonwealth of Virginia Administrative Code presents the freshwater copper water quality standards in terms of hardness as follows:

Copper, µg/L as Dissolved
Acute
WER $\{e^{(0.942[\ln(\text{hardness})]-1.700)}\}(0.96)$
Chronic
WER $\{e^{(0.85[\ln(\text{hardness})]-1.702)}\}(0.96)$

The range of hardness is from 25 to 400 mg/L and the WER is assumed as 1 unless a study demonstrates there is a more appropriate site specific WER. The WER of 1 means all the copper present is assumed to be fully bioavailable and hence in the most toxic form. The following Table 1 presents the acute and chronic values as a function of hardness.

Table 1

Commonwealth of Virginia Copper Freshwater Water Quality Standards

Freshwater

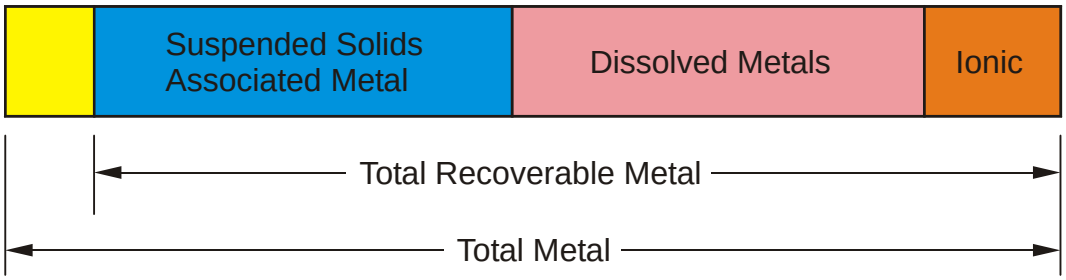
(WER=1)

Hardness mg/L $CaCO_3$	**Acute** Dissolved	**Chronic** Dissolved
25	3.64	2.74
50	7.28	4.95
75	10.24	7
100	13.42	8.96
125	16.57	10.84
150	19.7	12.66
175	22.75	14.44
200	25.8	16.19
225	28.82	17.91
250	31.83	19.59
275	34.82	21.26
300	37.78	22.9
325	40.75	24.5
350	43.7	26.12
375	46.63	27.7
400	49.56	29.28

Because the development of the copper water quality standards only considered hardness and there are many other water quality parameters which modify the toxicity of copper, the EPA provided extensive guidance on the necessary components of a WER. A WER for copper is a biological approach that compares the bioavailability and toxicity in the site specific receiving water with the synthetic laboratory test water. The synthetic laboratory test water is formulated to maximize the toxicity of metals. It is important to note the WER approach is as fully protective of the receiving water as the hardness only approach.

The aqueous metals can exist as total recoverable (virtually all the metal present), suspended solids associated metal and dissolved metal, see Figure 1.

Figure 1



Because only a part of the dissolved metals, mainly the ionic, are considered bioavailable, there is particular interest in this form. EPA has increasingly recognized when considering toxicity, the dissolved metals are an appropriate and conservative form. The Commonwealth of Virginia agrees with this EPA position and incorporates the dissolved form of copper in the freshwater water quality standards. Because the dissolved metal is a fraction of the total recoverable, there is a high probability that the copper dissolved concentrations will be lower than the total recoverable concentration. Copper has a great tendency to form complexes with dissolved organics, hence copper generally has a higher dissolved fraction than other metals, but the level is still below the total recoverable concentration. However the copper often forms strong complexes with the dissolved organics making it unavailable to biological processes. Hence, there is often a much lower toxic effect of an effluent copper as compared to the dissolved, ionic copper used in the criterion development. This characteristic is not fully addressed by either the total recoverable or the dissolved approach but is considered in the water effects ratio approach (WER).

Study Overview:

The WER method compares the toxicity of a metal (as a mineral salt) in the actual receiving stream water mixed with effluent to the toxicity of a metal in standardized laboratory water. The resulting LC50's (lethal concentration at which 50% of the organisms expire) are used to derive a water effect ratio which in turn can be used to adjust the national criteria. For the CM facility the 1Q10 and 7Q10 flows are 0 MGD. Therefore we will be using 100% final effluent to make the toxicity assay dilutions. The Streamlined WER Procedure will be utilized for the required metal as detailed in EPA 822-R-01-005,

"Streamlined Water-Effect Ratio Procedure for Discharges of Copper". Two tests will be performed with the primary species (*Ceriodaphnia dubia* or Daphnia magna). Four weeks will separate each sampling event.

Schedule:

The Plan of Study (POS) will be implemented by HRSD and EA Engineering, Science and Technology, Inc. (Hunt Valley, MD). The proposed schedule is for the first sample to be collected and tested as soon as possible, the second sample will be collected for testing no sooner than 4 weeks later.

Preparation of Sampling Equipment:

All sampling equipment including the tubing and glass collection jar will be prepared according to HRSD clean sampling standard operating procedures (specifically organics and metals clean). Before deploying equipment appropriate equipment blanks will be collected. Additionally, appropriate field blanks will be collected at the same time as final effluent samples. Metal, galvanized material, rubber, brass, copper, and lead will not be allowed to come in contact with effluent samples. Teflon tubing will be used in all composite samplers which utilize a peristaltic pump head.

Collection of Effluent:

Prior to deployment of sampling equipment, plant conditions will be evaluated to insure that normal operating conditions are being met. Normal plant monitoring data that is reported in the Discharge Monitoring Report (DMR) will be collected during this sampling exercise and compared to previously collected data to insure treatment facility was operating under normal conditions. In addition to collecting samples for toxicity testing additional samples will be collected for alkalinity (Method EPA 310.2), pH, TSS, DOC (Method SM5310C), hardness (Method SM2340B), and copper (total and dissolved - Method EPA 200.8) analysis. Additional samples will also be collected for parameters used for the Biotic Ligand Model (Ca, Mg, Na, K, Cl, SO_4, Sulfides). Effluent will be collected as a 24 hour time weighted composite sample from the Final Effluent Sample Point (FNE Sample Point). As the plant effluent comprises 100% of the receiving stream flow, no dilutant water will be collected.

All samples will be delivered to the laboratory for testing on wet ice. Field records will be completed on the chain of custody forms at the time the samples are collected. Field records contained the following information:

(a) Sample Description

(b) Date/Time of Sample Collection

(c) Preservative Used

(d) Analyses Required

(e) Name of Sample Collector

(f) Signature of Sample Collector

Chain of Custody records for the effluent samples will be completed. Each sample will be identified by affixing a pressure sensitive gummed label on the container(s). The label will contain the sample identification, sample point, preservative used, and the collector(s)' initials. HRSD standard operating procedures for the composite collection of clean samples, sample preservation, and handling will be used (see Water Quality Department WQ Field SOP Notebook). These SOP's can be provided upon request.

Immediately after completion of composite sampling, toxicity testing samples will be shipped overnight to EA's Ecotoxicology Laboratory on wet ice with appropriate paperwork (chain of custody, etc.).

Toxicity Testing:

Acquiring and Acclimating Test Organisms:

EA will use the water flea species *Ceriodaphnia dubia* for all toxicity testing. These organisms are cultured and maintained in EA's culture facility. The *C. dubia* cultures are maintained at 25±2°C on a 16 hour light, 8 hour dark photoperiod cycle in an environmentally controlled laboratory. Cultures are maintained individually in 30-mL plastic portion cups in brood boards, and are fed algae (*Selenastrum capricornutum*) and a trout chow/yeast/cereal leaves suspension (see US EPA 2002). New cultures are initiated on a routine basis to ensure healthy, productive populations. Organisms from cultures producing ephippia are not used for toxicity tests. Prior to beginning toxicity assay organisms will be conditioned for temperature and experimental test matrix.

Age of Test Organisms at Test Initiation:

C. dubia neonates of known age (i.e., < 24 hours old), from the individually cultured females in the brood board system, will be used for testing. On the day before or on the day of the toxicity test, these neonates will be segregated from the parent organisms and conditioned for the upcoming test.

Test Chambers and Measuring Devices:

EA Engineering will follow the recommendations of US EPA (2002) and/or ASTM (1999, 2000a, 2000b) regarding setting up facilities for conducting toxicity tests and selecting and cleaning the test chambers.

Laboratory Water:

EA uses a moderately hard synthetic freshwater prepared from deionized water and reagent grade chemicals (see US EPA 2002) for culturing and testing. For toxicity testing specifically related to this project however, laboratory water will be prepared that is similar in hardness, alkalinity, and pH to that of the final effluent sample. EA will also insure that laboratory water DOC, TOC, and TSS values are all less than 5 mg/L.

Conducting Tests:

Toxicity testing will be performed in an environmentally controlled laboratory where the temperature is maintained at 25±1°C with a 16 hour light, 8 hour dark photo period.

Testing will be done in a side by side manner with insurance that there are no differences in test conditions other than composition of the dilution water (final effluent sample vs. laboratory water).

Test concentration series will consist of both an unspiked laboratory and final effluent control treatment. In addition to control treatments, 6-8 treatments with copper additions (where copper concentrations decrease at a rate ≤ 50% between decreasing concentrations) will be tested using both laboratory and final effluent water. A minimum of 20 organisms in 4 replicates will be tested at each copper concentration, including all control treatments. Test organisms will be assigned randomly to the side-by-side tests, and will be from the same lot of organisms. Toxicity test duration will last 48 hours (24 hour check will be performed) with organism survival being the measured effect.

Test containers will consist of 30 mL portion cups or beakers. Final test volumes will be 15 mL.

Each day of test, test organisms will be observed to record mortality. Water quality measurements (dissolved oxygen, temperature, pH, and conductivity) will be measured from a minimum of 1 replicate from each treatment (from both laboratory water and final effluent sample tests) at test initiation, test termination, and all intermediate checks. In the event that after test initiation the dissolved oxygen in any test chamber is < 4 mg/L, all test chambers will be gently aerated (or some other corrective action taken).

For a test to be deemed valid the following conditions must be met in both the laboratory water and final effluent water treatments:

1. Control treatment mortality does not exceed 10%
2. Temperatures remained in the target range (25±1°C)
3. Tests were initiated within 36 hours of collection of final effluent

Individual tests may be conditionally accepted if dissolved oxygen, temperature, pH, and conductivity fall outside specifications, depending on the degree of the departure.

Analytical Verification of Test Concentrations:

The following samples will be analyzed for total copper:

- The highest test concentration that showed no lethality
- Concentrations that showed lethality to a portion of the organisms
- The lowest concentration that showed complete lethality, and:
- The Controls

Data Analysis:

The LC50 and/or EC50 values and associated statistics will be calculated using the Probit, Spearman-Karber, Trimmed Spearman-Karber, and/or other graphical methods as described by US EPA (2002). Depending on the nature of the data, other methods may be used. Whatever method is used will be specified in the final report. For comparison between single concentration replicates and control treatments, t-tests or other hypothesis testing statistics will be used.

Final Report:

The final report from each test will contain at the minimum the following information:

1. Objectives and procedures stated in the final approved protocol, including any changes made to original approved protocol.
2. Identity of the test samples by name and/or code number.
3. Test copper concentration series used in test and duration of toxicity assay.
4. Water quality characteristics of both laboratory water and final effluent sample test concentrations (selected replicates from each treatment) from throughout assay (dissolved oxygen, temperature, pH, and conductivity).
5. Measured concentrations of total copper in the selected test concentrations
6. Any unforeseen circumstances that may have occurred and/or affected the quality and/or integrity of the toxicity assay.
7. Signature of the project manager, senior technical reviewer, and quality control officer authorizing release of the final toxicity assay report.
8. Location of all archived data and the original copy of the final report at EA Engineering, Science and Technology, Inc. (Hunt Valley, MD)

Items of data to be included in the report consist of experimental design and test performance, effects on general appearance of test organisms (if applicable), morbidity and mortality, presentation of water quality characteristics, young production (if applicable), and survival data.

Reference Toxicant:

A reference toxicant test, utilizing sodium chloride (NaCl) will be used as an internal quality check of the sensitivity of the test organisms. Testing of reference toxicant is conducted at least once monthly on organisms which are cultured in house at EA Ecotoxicology Laboratory. Results of each reference test will be compared with historical tests to determine if the results are within acceptable limits. Acceptability limits are established using the control charts outlined in the US EPA (2002).

References:

ASTM. 1999. ASTM Standards on Biological Effects and Environmental Fate, 2nd Edition. American Society for Testing and Materials, West Conshohocken, PA.

ASTM. 2000a. E729-96 Standard Guide for Conducting Acute Toxicity Tests on Test Materials and Fishes, Macroinvertebrates, and Amphibians. American Society for Testing and Materials, West Conshohocken, PA.

ASTM. 2000b. E1192-97 Standard Guide for Conducting Acute Toxicity Tests on Aqueous Effluents with Fishes, Macroinvertebrates, and Amphibians. American Society for Testing and Materials, West Conshohocken, PA.

US EPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fifth Edition. EPA-821-R-02-012. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

Toxicity Test Details:

Test organism:	*Ceriodaphnia dubia*
Test Type:	Static, non-renewal
Organism Age:	Less than 24 hours
Temperature:	25±1°C
Light Quality:	Wide-spectrum fluorescent light
Light Intensity:	50-100 f.c.
Photoperiod:	16-hour light, 8-hour dark
Aeration:	None
Site Water:	Site water will be 100% final effluent, there will be no downstream dilution water in this toxicity assay
Lab Water:	Lab water will be synthetic freshwater prepared to match the hardness of the effluent
Test Container:	30-ml container
Test Volume:	15 ml
Number of Concentrations:	Definitive assay - Minimum of five test concentrations and a control Screening assay - Single test concentration and a control
Number of Replicates:	Four, with a fifth replicate for monitoring water quality
Number of Organisms per Replicate:	Five (fifth replicate does not contain organisms)
Feeding Regime:	Feed YCT and algae a minimum of 2 hours prior to use in test; for 96-hour test, feed 200 µl YCT and algae mixed at 48 hours (prior to renewal)
Test Duration:	48 hours
Endpoints:	Mortality
Test Acceptability:	≥90% survival in control

Attachment 2

COPPER WATER EFFECT RATIO (WER) TESTING FOR CENTRAL MIDDLESEX WWTP, VIRGINIA

Prepared for:

Hampton Roads Sanitation District
1436 Air Rail Ave.
Virginia Beach, VA 23455

Prepared by:

EA Engineering, Science, and Technology, Inc.
231 Schilling Circle
Hunt Valley, Maryland 21031
For questions concerning this report, please contact Wayne McCulloch
ph: 410-584-7000

Results relate only to the items tested or to the samples as received by the laboratory.

This report contains 11 pages plus 2 attachments.

Wayne L. McCulloch
Laboratory Director

Date

VA Laboratory ID# 460159

ACCREDITED IN ACCORDANCE WITH nelac ID# E87550

EA Report Number 6763

1. INTRODUCTION

At the request of Hampton Roads Sanitation District (HRSD), EA Engineering, Science, and Technology, Inc. performed acute toxicity tests with *Ceriodaphnia dubia* (water flea), as part of a copper water effect ratio (WER) study for the Central Middlesex WWTP, Virginia. Side-by-side tests were performed using 100 percent Central Middlesex WWTP final effluent as the test makeup water and a comparative test was performed using synthetic laboratory water with a similar hardness (20 mg/L hardness) as the final effluent for the test makeup water The objective of this acute toxicity testing was to assess the acute lethality of copper, administered as cupric chloride ($CuCl_2 \cdot 2H_2O$) to *C. dubia* in final effluent versus a synthetic laboratory water to compare the toxicity of copper in the two different types of makeup water. The goal of the study was to calculate a copper water effect ratio (WER) for the Central Middlesex WWTP wastewater.

2. METHODS AND MATERIALS

2.1 SAMPLE DESCRIPTION

On 12-13 August 2013, a 24-hour composite sample of final effluent was collected from the Central Middlesex WWTP facility by Hampton Roads Sanitation District (HRSD) personnel. The sample was packed on wet ice, and sent via overnight carrier to EA's Ecotoxicology Laboratory in Hunt Valley, Maryland. Upon receipt at EA on 14 August, the sample was visually inspected, logged in, and assigned EA Aquatic Toxicology accession number AT3-455.

The Central Middlesex WWTP final effluent was used as the makeup water for the site water acute toxicity test. Alkalinity, hardness, and conductivity measurements were taken on the samples according to US EPA (1979) and APHA et al. (2005). These selected water quality parameters are summarized in Table 2. In addition to the final effluent sample, a synthetic laboratory dilution water with hardness value similar to the effluent (20 mg/L hardness) served as the dilution water for the side-by-side lab water acute toxicity tests. All samples were stored in the dark at 4°C when not in use.

2.2 TEST MATERIAL

The test article was copper, administered as reagent grade cupric chloride ($CuCl_2 \cdot 2H_2O$). Stock solutions of copper, dissolved in deionized water, were used to prepare the test concentrations.

2.3 TEST ORGANISMS

Ceriodaphnia dubia were cultured in EA's Culturing Facility in Hunt Valley, Maryland using moderately hard synthetic freshwater. The cultures were kept in an environmentally controlled room at 25±1°C with a 16-hour light/8-hour dark photoperiod. Organisms were fed daily as described in US EPA (2002) and thinned as necessary to maintain healthy, productive cultures. Gravid adults were re-isolated and fed 24 hours before test initiation to ensure that neonates were less than 24 hours old when used for testing. The neonates were fed prior to test initiation.

2.4 CULTURE WATER

Moderately hard synthetic freshwater US EPA (2002) was used as the culture water for the *C. dubia* acute toxicity tests. Batches of this water were made by passing deionized water through activated carbon and adding reagent grade chemicals per US EPA guidance (2002), and aerating overnight. The water was stored at 25 °C under gentle aeration until needed.

2.5 WER DILUTION WATERS

The makeup waters for the Central Middlesex *C. dubia* site water acute toxicity test utilized 100 percent Central Middlesex WWTP final effluent. The final effluent sample had a hardness of 20.0 mg/L. The synthetic dilution water for the lab water *C. dubia* toxicity test was prepared by adding reagent grade chemicals to carbon polished deionized water at a concentration to deliver a hardness value of 20.0 mg/L.

2.6 TOXICITY TEST OPERATIONS AND PERFORMANCE

The acute toxicity tests were performed in accordance with US EPA guidelines, and methodology followed EA's testing protocols (2013). Prior to preparation of test solutions, aliquots of the final effluent and lab water were warmed to the desired test temperature of 25±1°C using a water bath. Test concentrations were prepared by spiking copper stock solutions into the appropriate dilution water. Each test solution was mixed and then split equally into the replicate test chambers. For the lab water test, the *C. dubia* were exposed to nominal concentrations of 1.0, 1.7, 2.9, 4.9, 8.3, 14.1 and 24 µg/L Cu, with a corresponding laboratory water control. For the site water test, the nominal test concentration series was 1.0, 1.7, 2.9, 4.9, 8.3, 14.1, 24.0, 40.8, 69.4 and 118 µg/L Cu, plus a 100 percent effluent control.

The 48-hour acute *C. dubia* tests were conducted in 30-ml plastic portion cups with 15 mls of test solution per cup. The less than 24 hour old *C. dubia* were loaded into the cups for a total of four replicates of five organisms per concentration. The *C. dubia* tests were conducted at 25±1°C with a

16-hour light/8-hour dark photoperiod. Water quality parameters (temperature, pH, dissolved oxygen, and conductivity) of test solutions were recorded daily on the test data sheets. Copies of the original data sheets, which include all water quality measurements and observations, are included in Attachment I.

Statistical analyses were performed according to US EPA guidance (2002) to determine the 48-hour median lethal concentrations (LC50s). The test data were analyzed using the ToxCalc statistical software package (Version 5.0, Tidepool Scientific Software). Chain-of-custody forms, raw data sheets, and copies of statistical output are included in Attachment I. The report Quality Assurance record is included in Attachment II.

2.7 REFERENCE TOXICANT TEST

In conformance with EA's quality assurance/quality control program, a monthly reference toxicant test was performed on the in-house cultured *C. dubia*. The *C. dubia* were exposed to a graded concentration series of the reference toxicant sodium chloride (NaCl) to determine the 48-hour LC50 value. The results were compared to the established control chart limits set by EA.

2.8 ARCHIVES

Original data sheets, records, memoranda, notes, and computer printouts are archived at EA's office in Hunt Valley, Maryland. The primary data and other related information will be retained for a period of 5 years unless HRSD requests a longer period of time.

3. RESULTS AND DISCUSSION

3.1 LAB WATER *Ceriodaphnia dubia* TOXICITY TEST

The results of the lab water (20.0 mg/L hardness) *Ceriodaphnia dubia* acute toxicity test, which was conducted side-by-side with the Central Middlesex WWTP final effluent test, are presented in Table 1. After 48 hours of exposure, there was 0, 15 and 70 percent survival in the 4.96, 2.99 and 1.47 µg/L measured total Cu test concentrations. There was 90 percent survival in the 1.33 µg/L measured total Cu test concentration and 100 percent survival in the laboratory control. For the 20.0 mg/L hardness laboratory water test, the *C. dubia* 48-hour LC50 value was 1.95 µg/L measured total Cu. The 95 percent confidence limits for the LC50 were 1.69-2.29 µg/L measured total Cu.

3.2 FINAL EFFLUENT *Ceriodaphnia dubia* TOXICITY TEST

The results of the Central Middlesex WWTP final effluent acute toxicity test with *C. dubia* are also presented in Table 1. After 48 hours of exposure, there was 65 and 95 percent survival in 107 and 59.3 µg/L measured total Cu test concentrations, respectively. There was 100 percent survival in the 36.9 µg/L concentration and in the 100 percent Central Middlesex WWTP final effluent control. The resulting 48-hour *C. dubia* LC50 for the final effluent test was >107 µg/L measured total Cu. The 95 percent confidence limits for the LC50 were not calculable.

3.4 CALCULATION OF THE WATER EFFECTS RATIO

The water effect ratio (WER) is calculated as follows:

$$WER = \frac{\text{Final Effluent LC50}}{\text{Lab Water LC50}}$$

For the Central Middlesex final effluent, the WER for copper based on measured concentrations was >54.9.

3.5 REFERENCE TOXICANT TEST

In accordance with EA's quality control/quality assurance program, a reference toxicant test was conducted on the in-house cultured stock of *C. dubia* using sodium chloride (NaCl) as the reference toxicant. The 48-hour LC50 value for the August 2013 *C. dubia* test was 1,980 mg/L NaCl, which fell within EA's acceptable control chart limits of 1,599-2,120 mg/L NaCl (page 9).

4. REFERENCES

American Public Health Association, American Water Works Association, Water Environment Federation. 2005. Standard Methods for the Examination of Water and Wastewater. 21st Edition. APHA, Washington, D.C.

EA. 2013. EA Ecotoxicology Laboratory Quality Assurance and Standard Operating Procedures Manual. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., Hunt Valley, Maryland.

US EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA/600/4-79/020. Environmental Protection Agency, Cincinnati, Ohio.

US EPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fifth Edition. EPA-821-R-02-012. U.S. Environmental Protection Agency, Office of Water, Washington, D. C.

SUMMARY OF SAMPLE/TEST INFORMATION

Test: ***Ceriodaphnia dubia* 48-hour static acute toxicity test**

Client Name: **Central Middlesex WWTP**

Test Procedure: **EA Protocol CD-AC-02**
Acute assay with *Ceriodaphnia dubia*

Final Effluent: **Central Middlesex Wastewater Treatment Plant, Virginia**

Laboratory Water Description: **Synthetic freshwater (20.0 mg/L hardness)**

Number of Replicates per Concentration: **4**

Number of Organisms per Replicate: **5**

Test Chamber: **30-ml cup**

Volume per Test Chamber: **15 ml**

Organism Lot Information

Lot Number: Not Applicable
Source: EA's Culture Facility (Hunt Valley, Maryland)
Age: <24 hours old

Reference Toxicant Test Information

Reference Toxicant: Sodium chloride (NaCl)
EA Test Number: RT-13-099
Dilution Water: Moderately hard synthetic freshwater
48-hour LC50: 1,980 mg/L NaCl
Laboratory control chart acceptability range for 48-hour LC50: 1,599-2,120 mg/L NaCl

TABLE 1 WER TESTING FOR CENTRAL MIDDLESEX WWTP, VIRGINIA

Sample Description:	**Lab Water (20 mg/L hardness)**		**Central Middlesex Final Effluent**
EA Sample Accession Number:	LD3-344		AT3-455
Sample collection dates:	NA		8/12/13-8/13/13
Sample receipt date:	NA		8/14/13
Test Organism:	***Ceriodaphnia dubia***		***Ceriodaphnia dubia***
EA Test Number:	**TN-13-475**		**TN-13-476**
Test Initiation and Date:	1420, 8/14/13		1400, 8/14/13
Test Termination and Date:	1424, 8/16/13		1415, 8/16/13
Test Concentration (µg/L Cu)	48-Hour Percent Survival	Test Concentration (µg/L Cu)	48-Hour Percent Survival
Control [<0.5][a]	100	Control [2.97]	100
1.0 [1.33]	90	1.0	100
1.7 [1.47]	70	1.7	100
2.9 [2.99]	15	2.9	100
4.9 [4.96]	0	4.9	100
8.3	0	8.3	100
14.1	0	14.1	100
24.0	0	24.0	100
		40.8 [36.9]	100
		69.4 [59.3]	95
		118.0 [107]	65
48-Hour LC50[b] (µg/L Cu):	**1.95 (1.69-2.29)**[c]		**>107 (NC)**[d] **WER >54.9**
Selected Test Water Quality			
Temperature (°C):	24.0 – 24.6		24.0 – 24.6
pH:	7.3 – 8.1		8.5 – 8.8
Dissolved Oxygen (mg/L):	7.8 – 9.0		6.5 – 8.1
Conductivity (µS/cm):	83 – 126		841 – 1,009

(a) Measured total copper values in brackets.
(b) LC50 calculation based on measured total copper concentrations.
(c) Values in parentheses are 95 percent confidence limits.
(d) 95 percent confidence limits were not calculable.

TABLE 2 SUMMARY OF WATER QUALITY PARAMETERS MEASURED UPON RECEIPT OF AUGUST 2013 SAMPLES FROM CENTRAL MIDDLESEX WWTP

Accession Number	Temperature (°C)	pH	TRC (mg/L)	Alkalinity (mg/L)	Hardness (mg/L)	Conductivity (µS/cm)	TSS (mg/L)	TOC (mg/L)	DOC (mg/L)
Central Middlesex Final Effluent:									
AT3-455	0.6	8.8	<0.01	236	20	949	<1.0	2.21	2.28
Lab Water:									
LD3-344	NA	NA	NA	20	20	93	<1.0	<1.0	<1.0

ATTACHMENT I

Data Sheets and Statistical Analyses
(32 pages)

Chain-of-Custody Record

EA Engineering, Science, and Technology

EA Ecotoxicology Laboratory
231 Schilling Circle
Hunt Valley, Maryland 21031
Telephone: 410-584-7000
Fax: 410-584-1057

Sample Shipped By: (circle)
Fed. Ex. UPS Other: _____
Tracking #: 796412181901

Client: Hampton Rds. San. Dis. Project No.: _____

NPDES Number: _____ Client Purchase Order Number: _____

City/State Collected: Salida, VA

PLEASE READ SAMPLING INSTRUCTIONS ON BACK OF FORM

Accession Number (office use only)	Grab	Composite	Collection Start Date/Time	Collection End Date/Time	Sample Description (including Site, Station Number, and Outfall Number)	Number/Volume of Container
AT3-455		✓	081213/934	081313/934	Central Middlesex WWTP Final Eff.	2/1gal

Sampled By:	Date/Time	Received By:	Date/Time
M. Bertsch	081313/0934		
Sampler's Printed Name:	Title:	Relinquished By:	Date/Time
Molly Bertsch	W.Q. Technician		
Relinquished By:	Date/Time	Received By Laboratory	Date/Time
M. Bertsch	081313/	[illegible]	8/14/13 0930

Was Sample Chilled During Collection? (Yes) / No

Comments:

Sample Collection Parameters

Visual Description: No visible particulates
Temperature (°C): 12.6
pH: 8.66
TRC (mg/L): 0
Other:

White-Report Production
Yellow-Laboratory
Pink-Client/Sampler

SAMPLE CHECK-IN FOR TESTING

Client: HRSD

EA Accession Number: AT3-455

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	0.6	8/14/13	0930	HW/VV
Is ice present?	---	YES	↓	↓	↓
pH	6.0-9.0	8.8	↓	↓	↓
TRC (mg/L)	<0.01	<0.01	↓	↓	↓
Visual Description	---	clear	↓	↓	↓

***If outside acceptable range, contact project manager.**

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✓)	Date	Time	Initials
Ammonia (preserve aliquot)	--				
Parameter	**Acceptable Range**	**Measurement***	**Date**	**Time**	**Initials**
Salinity (ppt)	--				

TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN-13-475

TEST ORGANISM INFORMATION

Common Name: Water flea
Scientific Name: Ceriodaphnia dubia
Lot Number: NA
Source: EA

Adults Isolated (Time, Date): 1602 8/13/13
Neonates Pulled & Fed (Time, Date): 0849 8/14/13
Acclimation: < 24 hrs Age: < 24 hrs
Culture Water (T/S): 24.1 °C Ø ppt

TEST INITIATION

Date	Time	Initials	Activity
8/14/13	1327	VY	Dilutions Made
	↓		Test Vessels Filled
	1420	↓	Organisms Transferred
↓	1444	MJ	Head Counts

TEST SET-UP

Sample Number: COPPER
Dilution Number: LD3-344

Stock (B) = 1,000 µg/L = 1 µg/ml
Stock (C) = 100 µg/L = 0.1 µg/ml

µg/L Cu

Test Concentration	Volume Test Material	Final Volume
LAB CONTROL	—	300mls
1	3mls Stock (C)	↓
1.7	5.1mls (C)	
2.9	8.7mls (C)	
4.9	14.7mls (C)	
8.3	2.5mls (B)	
14.1	4.2mls (B)	
24	7.2mls (B)	

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD-Central Middlesex
QC Test Number: TN-13-475
Test Material: COPPER
Accession Number: SP3-039,040
Dilution Water: SOFT WATER (20mg/L)
Accession Number: LD3-344

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥4.0 mg/L
pH: 6.0 - 9.0 Salinity: ϕ ppt
Photoperiod: 16 ℓ, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 8/14/13 Time: 1420
Ending Date: 8/16/13 Time: 1424
TEST TYPE: (Static) / Flowthrough
Renewal / Non-renewal
Test Container: 30 ml cup
Test Volume: 15 mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
LAB CONTROL	A	5	5	5			24.0	24.1	24.2			7.6	7.7	8.1			8.3	7.9	7.9			92.5	110.1	126.1		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
1	A	5	5	5			24.0	24.1	24.2			7.6	7.6	7.9			8.5	7.9	8.0			85.9	89.8	95.4		
	B	5	5	5																						
	C	5	5	3																						
	D	5	5	5																						
1.7	A	5	3	3			24.0	24.1	24.4			7.4	7.5	8.0			8.3	7.9	8.0			85.2	87.8	90.5		
	B	5	3	3																						
	C	5	3	3																						
	D	5	5	5																						
Meter Number							677	677	675			677	677	675			677	677	675			677	677	675		
Time		1444	1415	1424			1335	0855	0955			1335	0855	0955			1335	0855	0955			1335	0855	0955		
Initials		MJ	CH	MJ			VY	MJ	MJ			VY	MJ	MJ			VY	MJ	MJ			VY	MJ	MJ		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0 _____ Americamysis: 2007.0 _____ Menidia:2006.0 _____
Magna/pulex: 2021.0 _____ Trout: 2019.0 _____ Cyprinodon: 2004.0 _____ OTHER: _____

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD-Central Middlesex
QC Test Number: TN-13-475
Test Material: COPPER
Accession Number: SP3-039, 040
Dilution Water: SOFT WATER (20mg/L)
Accession Number: LD3-344

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥4.0 mg/L
pH: 6.0 - 9.0 Salinity: ϕ ppt
Photoperiod: 16ℓ 8d Light Intensity: 50 - 100 fc

Beginning Date: 8/14/13 Time: 1420
Ending Date: 8/16/13 Time: 1424
TEST TYPE: (Static) / Flowthrough
Renewal / Non-renewal
Test Container: 30 ml cup
Test Volume: 15 mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
2.9	A	5	2	1			24.0	24.2	24.6			7.4	7.5	7.9			8.7	8.0	7.9			84.4	86.9	88.7		
	B	5	2	2																						
	C	5	1	0																						
	D	5	0	0													8.7									
4.9	A	5	0	0			24.0	24.2	—			7.3	7.4	—			~~8.6~~	7.9	—			82.7	85.0	—		
	B	5	0	0																						
	C	5	0	0																						
	D	5	0	0																						
8.3	A	5	0	0			24.0	24.3	—			7.3	7.4	—			9.0	7.9	—			85.9	87.7	—		
	B	5	0	0																						
	C	5	0	0																						
	D	5	0	0																						
Meter Number							677	677	675			677	677	675			677	677	675			677	677	675		
Time		1444	1415	1424			1335	0855	0955			1335	0855	0955			1335	0855	0955			1335	0855	0955		
Initials		MJ	CM	MJ			VY	MJ	MJ			VY	MJ	MJ			VY	MJ	MJ			VY	MJ	MJ		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0_____ Americamysis: 2007.0_____ Menidia:2006.0_____
Magna/pulex: 2021.0_____ Trout: 2019.0_____ Cyprinodon: 2004.0_____ OTHER: _____

12/02/08
ATS-T01

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD-Central Middlesex
QC Test Number: TN-13-475
Test Material: COPPER
Accession Number: SP3-039, 040
Dilution Water: SOFT WATER (20mg/L)
Accession Number: LD3-344

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥4.0 mg/L
pH: 6.0 - 9.0 Salinity: ϕ ppt
Photoperiod: 16 ℓ, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 8/14/13 Time: 1420
Ending Date: 8/16/13 Time: 1424
TEST TYPE: (Static) / Flowthrough
Renewal / Non-renewal
Test Container: 30 ml cup
Test Volume: 15 mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms 0	24	48	72	96	Temperature (°C) 0	24	48	72	96	pH 0	24	48	72	96	Dissolved Oxygen (mg/L) 0	24	48	72	96	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	24	48	72	96
14.1	A	5	0	0			24.0	24.2	—			7.3	7.3	—			8.8	7.8	—			85.6	88.0	—		
	B	5	0	0																						
	C	5	0	0																						
	D	5	0	0																						
24	A	5	0	0			24.0	24.2	—			7.3	7.3	—			8.9	7.9	—			84.8	87.5	—		
	B	5	0	0																						
	C	5	0	0																						
	D	5	0	0																						
	A	~~5~~																								
	B	~~5~~																								
	C	~~5~~																								
	D	~~5~~																								
Meter Number							677	677				677	677				677	677				677	677			
Time		1414	1415	1424			1335	0855				1335	0855				1335	0855				1335	0855			
Initials		MJ	VH	MJ			VH	MJ				VH	MJ				VH	MJ				VH	MJ			

VH 8/14

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0 Americamysis: 2007.0 Menidia:2006.0
Magna/pulex: 2021.0 Trout: 2019.0 Cyprinodon: 2004.0 OTHER:

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005.08

Client: HRSD/Central Middlesex

QC Test Number: TN-13-475

Date/Time/Initials	Comments/Activity

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005.08

Client: HRSD/Central Middlesex

QC Test Number: TN-13-475

Aliquot of sample warmed to test temperature, then aerated if supersaturated:

Date	Sample #	ON AIR			OFF AIR		
		Initial DO (mg/L)	Time	Initials	Final DO (mg/L)	Time	Initials

HRSD - WER (Copper)

Copper Chloride Stocks - $CuCl_2 \cdot 2H_2O$ (FW 170.48)

Stock (A) 0.1 g/L = 100 µg/ml — 0.268g $CuCl_2 \cdot 2H_2O$ → 1,000ml D.I H_2O

Stock (B) 1,000 µg/L = 1.0 µg/ml — 10ml Stock (A) → 1,000ml vol w/ D.I H_2O

Stock (C) 100 µg/L = 0.1 µg/ml — 50ml Stock (B) → 500ml vol w/ D.I H_2O

Concentration Control	Vol Cu Stock	—	Total Vol 300ml
1 µg/L Cu	3ml	Stock (C)	
1.7	5.1ml	(C)	
2.9	8.7ml	(C)	
4.9	14.7ml	(C)	
8.3	2.5ml	(B)	
14.1	4.2ml	(B)	
24	7.2ml	(B)	
40.8	12.2ml	(B)	
69.4	20.8ml	(B)	
118	35.4ml	(B)	

Acute Toxicity Test-48 Hr Survival

Start Date:	8/14/2013	Test ID:	TN-13-475	Sample ID:	HRSD/Central Middlesex
End Date:	8/16/2013	Lab ID:		Sample Type:	Copper WER-Lab Water(20mg/L)
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-ug/L	1	2	3	4
Control	1.0000	1.0000	1.0000	1.0000
1.33	1.0000	1.0000	0.6000	1.0000
1.47	0.6000	0.6000	0.6000	1.0000
2.99	0.2000	0.4000	0.0000	0.0000
4.96	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			0	20
1.33	0.9000	0.9000	1.2305	0.8861	1.3453	18.660	4	16.00	10.00	2	20
1.47	0.7000	0.7000	1.0009	0.8861	1.3453	22.940	4	12.00	10.00	6	20
*2.99	0.1500	0.1500	0.3998	0.2255	0.6847	55.174	4	10.00	10.00	17	20
4.96	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96498	0.844	0.17996	0.23812
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	1.47	2.99	2.0965	

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	6.14323	1.11602	3.95583	8.33062	0	1.29914	5.99146	0.52	0.2894	0.16278	3
Intercept	3.22213	0.34601	2.54395	3.9003							
TSCR											

Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	0.81418	0.50571	1.03826
EC05	3.355	1.05112	0.74232	1.26969
EC10	3.718	1.20446	0.90666	1.42003
EC15	3.964	1.32036	1.03422	1.53645
EC20	4.158	1.42038	1.14504	1.64036
EC25	4.326	1.5122	1.2462	1.73975
EC40	4.747	1.77078	1.51927	2.04858
EC50	5.000	1.94717	1.68994	2.28914
EC60	5.253	2.14114	1.86217	2.58214
EC75	5.674	2.50725	2.15387	3.20475
EC80	5.842	2.66934	2.27338	3.50471
EC85	6.036	2.87154	2.41676	3.89694
EC90	6.282	3.14787	2.60479	4.46244
EC95	6.645	3.60707	2.90248	5.47047
EC99	7.326	4.65682	3.53691	8.05847

Reviewed by: 10/28/13

TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70005.08
Client: HRSD/Central Middlesex
QC Test Number: TN-13-476

TEST ORGANISM INFORMATION

Common Name: Water flea
Scientific Name: Ceriodaphnia dubia
Lot Number: NA
Source: EA

Adults Isolated (Time, Date): 1602, ~~8/13/13~~ 8/13/13 HW 8/14
Neonates Pulled & Fed (Time, Date): 0902, 8/14/13
Acclimation: <24hrs Age: <24hrs
Culture Water (T/S): 24.1 °C ϕ ppt

TEST INITIATION

Date	Time	Initials	Activity
8/14/13	1335	HW	Dilutions Made
↓	1335	HW	Test Vessels Filled
	1400	HW	Organisms Transferred
	1432	MJ	Head Counts

TEST SET-UP

Sample Number: COPPER
Dilution Number: AT3-455

STOCK (B) = 1,000 µg/L = 1 µg/ml
STOCK (C) = 100 µg/L = 0.1 µg/ml

µg/L Cu

Test Concentration	Volume Test Material	Final Volume
Effluent Control	3 mls Stock (C)	300 mls
1	5.1 mls (C)	↓
1.7	8.7 mls (C)	
2.9	14.7 mls (C)	
4.9	2.5 mls (B)	
8.3	4.2 mls (B)	
14.1	7.2 mls (B)	
24	12.2 mls (B)	
40.8	20.8 mls (B)	
69.4	35.4 mls (B)	
118	↓	

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD-Central Middlesex
QC Test Number: TN-13-476
Test Material: COPPER
Accession Number: SP3-039,040
Dilution Water: EFFLUENT
Accession Number: AT3-455

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥4.0 mg/L
pH: 6.0 - 9.0 Salinity: ϕ ppt
Photoperiod: 16 l, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 8/14/13 Time: 1400
Ending Date: 8/16/13 Time: 1415
TEST TYPE: (Static) / Flowthrough
Renewal / Non-renewal
Test Container: 30 ml cup
Test Volume: 15 mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
EFFLUENT	A	5	5	5			24.0	24.0	24.0			8.5	8.8	8.6			7.9	7.0	7.9			948	972	1009		
CONTROL	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
1	A	5	5	5			24.0	24.0	24.0			8.5	8.8	8.7			7.9	6.8	7.6			942	965	994		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
1.7	A	5	5	5			24.0	24.0	24.4			8.5	8.8	8.7			8.0	7.2	7.6			935	952	975		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
Meter Number							677	675	675			677	675	675			677	675	675			677	675	675		
Time		1432	1405	1415			1350	0842	1002			1350	0842	1002			1350	0842	1002			1350	0842	1002		
Initials		MJ	CH	MJ			HW	CH	MJ			HW	CH	MJ			HW	CH	MJ			HW	CH	MJ		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0_____ Americamysis: 2007.0_____ Menidia:2006.0_____
Magna/pulex: 2021.0_____ Trout: 2019.0_____ Cyprinodon: 2004.0_____ OTHER: _____

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD-Central Middlesex
QC Test Number: TN-13-476
Test Material: COPPER
Accession Number: SP3-039,040
Dilution Water: EFFLUENT
Accession Number: AT3-455

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥4.0 mg/L
pH: 6.0 - 9.0 Salinity: ϕ ppt
Photoperiod: 16 ℓ, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 8/14/13 Time: 1400
Ending Date: 8/16/13 Time: 1415
TEST TYPE: (Static) / Flowthrough
Renewal / Non-renewal
Test Container: 30 ml cup
Test Volume: 15 mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
2.9	A	5	5	5			24.0	24.2	24.6			8.5	8.8	8.7			7.8	7.1	7.5			923	948	949		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
4.9	A	5	5	5			24.0	24.3	24.6			8.5	8.8	8.7			7.8	7.2	7.5			907	922	937		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
8.3	A	5	5	5			24.1	24.3	24.6			8.5	8.8	8.7			7.7	7.1	7.4			941	954	970		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
Meter Number							677	675	675			677	675	675			677	675	675			677	675	675		
Time		1432	1405	1415			1350	0842	1002			1350	0842	1002			1350	0842	1002			1350	0842	1002		
Initials		MJ	CH	MJ			HW	CH	MJ			HW	CH	MJ			HW	CH	MJ			HW	CH	MJ		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0_____ Americamysis: 2007.0_____ Menidia:2006.0_____
Magna/pulex: 2021.0_____ Trout: 2019.0_____ Cyprinodon: 2004.0_____ OTHER:_____

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD-Central Middlesex
QC Test Number: TN-13-476
Test Material: COPPER
Accession Number: SP3 039,040
Dilution Water: EFFLUENT
Accession Number: AT3-455

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥4.0 mg/L
pH: 6.0 - 9.0 Salinity: ϕ ppt
Photoperiod: 16 ℓ, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 8/14/13 Time: 1400
Ending Date: 8/16/13 Time: 1415
TEST TYPE: (Static) / Flowthrough
Renewal / Non-renewal
Test Container: 30 ml cup
Test Volume: 15 mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
14.1	A	5	5	5			24.1	24.3	24.5			8.5	8.8	8.7			7.7	7.5	7.4			936	957	975		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
24	A	5	5	5			24.1	24.2	24.5			8.5	8.8	8.7			8.1	7.5	7.0			928	943	970		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
40.8	A	5	5	5			24.2	24.2	24.5			8.5	8.8	8.7			7.6	6.6	7.2			910	937	977		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
Meter Number							677	675	675			677	675	675			677	675	675			677	675	675		
Time		1432	1405	1415			1350	0842	1002			1350	0842	1002			1350	0842	1002			1350	0842	1002		
Initials		MJ	CH	MJ			HW	CH	MJ			HW	CH	MJ			HW	CH	MJ			HW	CH	MJ		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0 Americamysis: 2007.0 Menidia:2006.0
Magna/pulex: 2021.0 Trout: 2019.0 Cyprinodon: 2004.0 OTHER:

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD-Central Middlesex
QC Test Number: TN-13-476
Test Material: COPPER
Accession Number: SP3-039,040
Dilution Water: EFFLUENT
Accession Number: AT3-455

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥4.0 mg/L
pH: 6.0 - 9.0 Salinity: ϕ ppt
Photoperiod: 16 ℓ, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 8/14/13 Time: 1400
Ending Date: 8/16/13 Time: 1415
TEST TYPE: (Static) / Flowthrough
Renewal / Non-renewal
Test Container: 30 ml cup
Test Volume: 15 mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
69.4	A	5	5	5			24.3	24.2	24.4			8.5	8.8	8.7			7.6	6.9	7.6			885	918	975		
	B	5	4	4																						
	C	5	5	5																						
	D	5	5	5																						
118	A	5	4	4			24.5	24.0	24.2			8.5	8.7	8.7			7.8	6.5	7.7			841	877	927		
	B	5	4	3																						
	C	5	3	3																						
	D	5	3	3																						
	A																									
	B																									
	C																									
	D																									
Meter Number							677	675	675			677	675	675			677	675	675			677	675	675		
Time		1432	1405	1415			1350	0847	1002			1350	0842	1002			1350	0842	1002			1350	0842	1002		
Initials		MJ	CH	MJ			HW	CH	MJ			HW	CH	MJ			HW	CH	MJ			HW	CH	MJ		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0_____ Americamysis: 2007.0_____ Menidia:2006.0_____
Magna/pulex: 2021.0_____ Trout: 2019.0_____ Cyprinodon: 2004.0_____ OTHER:_____

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005.08

Client: HRSD/Central Middlesex

QC Test Number: TN-13-476

Date/Time/Initials	Comments/Activity

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005.08
Client: HRSD/Central Middlesex
QC Test Number: TD-13-476

Aliquot of sample warmed to test temperature, then aerated if supersaturated:

		ON AIR			OFF AIR		
Date	Sample #	Initial DO (mg/L)	Time	Initials	Final DO (mg/L)	Time	Initials
8/4/13	AT3-455 1of2	9.6	1008	MJ	7.8	1018	MJ
↓	2of2	8.5	↓	↓	8.4	↓	↓

HRSD - WER (Copper)

Copper Chloride Stocks - $CuCl_2 \cdot 2H_2O$ (FW 170.48)

Stock (A) 0.1 g/L = 100 µg/ml — 0.268g $CuCl_2 \cdot 2H_2O$ → 1,000ml D.I H_2O

Stock (B) 1,000 µg/L = 1.0 µg/ml — 10ml Stock (A) → 1,000ml vol w/ D.I H_2O

Stock (C) 100 µg/L = 0.1 µg/ml — 50ml Stock (B) → 500ml vol w/ D.I H_2O

Concentration Control	Vol Cu Stock		Total Vol
	—		300 ml
1 µg/L Cu	3ml	Stock (C)	
1.7	5.1ml	(C)	
2.9	8.7ml	(C)	
4.9	14.7ml	(C)	
8.3	2.5ml	(B)	
14.1	4.2ml	(B)	
24	7.2ml	(B)	
40.8	12.2ml	(B)	
69.4	20.8ml	(B)	
118	35.4ml	(B)	

Effluent ↓

Acute Toxicity Test-48 Hr Survival

Start Date:	8/14/2013	Test ID:	TN-13-476	Sample ID:	HRSD/Central Middlesex
End Date:	8/16/2013	Lab ID:		Sample Type:	Copper WER-Final Effluent
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-ug/L	1	2	3	4
Control	1.0000	1.0000	1.0000	1.0000
36.9	1.0000	1.0000	1.0000	1.0000
59.3	1.0000	0.8000	1.0000	1.0000
107	0.8000	0.6000	0.6000	0.6000

			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			1.0000	1.0000
36.9	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
59.3	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4	16.00	10.00	0.9500	0.9500
*107	0.6500	0.6500	0.9413	0.8861	1.1071	11.742	4	10.00	10.00	0.6500	0.6500

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.87418	0.844	-0.2011	2.86568
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	59.3	107	79.6561	

Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	59.300	7.607	35.407	72.020	-0.4867
IC10	67.250	6.674	42.583	79.970	-0.6203
IC15	75.200	6.418	49.760	87.920	-0.7057
IC20	83.150	5.727	63.975	102.230	-0.1070
IC25	91.100				
IC40	>107				
IC50	>107				

Reviewed by: 10/28/13

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1432 AIR RAIL AVENUE
VIRGINIA BEACH, VA 23455
TEL: 757-460-4214
FAX: 757-460-6586

CHAIN OF CUSTODY

PROJECT NAME/CODE: Central Middlesex Plant

ANALYSES REQUESTED, CGN & NUMBER OF CONTAINERS

CUSTOMER SAMPLE ID	HRSD Use Only: PROJECT CODE	HRSD Use Only: SAMPLE POINT	DATE	TIME	SAMPLED BY	Circle One: MATRIX	Circle One: SAMPLE TYPE	TSS (1)	TOTAL METALS (5) Total Copper	DOC (61)	TOC (29)				Project In Lims? Yes x / No: HRSD Use Only: Presv'd Checked	HRSD Use Only: CONT. COUNT
TN-475-Control	CM	CMCTRL_1	8/14/13	1512	WSM	L	G	1	1	1	1					
TN-475-1	CM	CMCTRL_2	"	"	"	L	G		1							
TN-475-1.7	CM	CMCTRL_3	"	"	"	L	G		1							
TN-475-2.9	CM	CMCTRL_4	"	"	"	L	G		1							
TN-475-4.9	CM	CMCTRL_5	"	"	"	L	G		1							
	CM	CMCTRL_6				L	G		1							
	CM	CMCTRL_7				L	G		1							
	CM	CMCTRL_8				L	G		1							
	CM	CMCTRL_9				L	G		1							
	CM	CMCTRL_10				L	G		1							

COMMENTS:

For Ground Water Use Only
Temp Blank 1: ____ °C
Temp Blank 2: ____ °C

Relinquished by / Signature W. Wayne McCullock	Date/Time 8/19/13 1230
Received by / Signature	Date/Time
Relinquished by / Signature	Date/Time
Received by / Signature	Date/Time
Relinquished by / Signature	Date/Time
Received by / Signature	Date/Time
Relinquished by / Signature	Date/Time
Received by / Signature	Date/Time

Temp. Requirement

Where required, submitted samples were transported in coolers maintained at ≤ 6 °C.

Yes_____ No_____

Int_____

***Preservatives**

- *Hg, Metals (pH<2 - HNO3) (Clean metals check in section)
- *O&G (pH<2 - HCl, check in section) & store ≤ 6 °C
- CN^- (pH>12 - NaOH) & store ≤ 6 °C
- *Sulfide (pH>9 - NaOH+ZnAc) & store ≤ 6 °C
- *Micro ($Na_2S_2O_3$ + EDTA) & store < 10 °C
- *COD, NUT, Phenols (pH<2 - H_2SO_4) & store ≤ 6 °C
- *TOC (pH<2 - H_3PO_4) & store ≤ 6 °C
- *BOD, TSS, TVSS, Turbidity, Surfactant, Sulfate store ≤ 6 °C
- *NUT Non Acidified, Conductivity, Organics store ≤ 6 °C
- *Cr (VI) (pH 9.3 - 9.7 - $(NH_4)_2SO_4$) & store ≤ 6 °C

All sample(s) met proper *preservation requirements. Yes _____ No_____ Int _____

Sample Type: C=Composite, G=Grab Matrix: L= Liquid , S = Solid **CGN:** Container Group Number

NOTE: ALL APPLICABLE INFORMATION MUST BE COMPLETED PRIOR TO ACCEPTANCE.

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT1 / TN-475-Control
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	<0.50	0.50	KWILLI	08/23/13	12:30
Others							
TSS	SM 2540 D	mg/L	<1.0	1.0	RCASTR	8/20/13	16:34
DOC	SM 5310C	mg/L	<1.00	1.0	RMORGA	08/22/13	07:05
TOC	SM 5310C	mg/L	<1.00	1.0	RMORGA	08/22/13	06:42

Authorization:_____ **Report Date:** _____
Lab Manager / QA Manager

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT5 TN-475-1.0
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	1.33	0.50	KWILLI	08/23/13	13:11

Authorization:_____
Lab Manager / QA Manager

Report Date: _____

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT3 TS-475-L-7
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	1.47	0.50	KWILLI	08/23/13	12:41

Authorization: _____
Lab Manager / QA Manager

Report Date: _____

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT4 TN-475-2.9
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	2.99	0.50	KWILLI	08/23/13	12:47

Authorization:_____
Lab Manager / QA Manager

Report Date: _____

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT2 TN-475-49
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	4.96	0.50	KWILLI	08/23/13	12:36

Authorization: _____
Lab Manager / QA Manager

Report Date: _____

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VIRGINIA BEACH, VA 23455
TEL: 757-460-4214
FAX: 757-460-6586

CHAIN OF CUSTODY

PROJECT NAME/CODE: Central Middlesex Plant

CUSTOMER SAMPLE ID	HRSD Use Only: PROJECT CODE	HRSD Use Only: SAMPLE POINT	DATE	TIME	SAMPLED BY	Circle One: MATRIX	Circle One: SAMPLE TYPE	ANALYSES REQUESTED, CGN & NUMBER OF CONTAINERS: TSS (1)	TOTAL METALS (5) TOTAL COPPER	DOC (61)	TOC (29)				Project In Lims? Yes _x_ No _____ / HRSD Use Only: Presv'd Checked	CONT. COUNT
TN-476-Control	CM	CMCTRL_1	8/14/13	1519	WM	L	G	1	1	1	1					
TN-476-40.8	CM	CMCTRL_2	↓	↓	↓	L	G		1							
TN-476-69.4	CM	CMCTRL_3				L	G		1							
TN-476-118	CM	CMCTRL_4				L	G		1							
	CM	CMCTRL_5				L	G		1							
	CM	CMCTRL_6				L	G		1							
	CM	CMCTRL_7				L	G		1							
	CM	CMCTRL_8				L	G		1							
	CM	CMCTRL_9				L	G		1							
	CM	CMCTRL_10				L	G		1							

COMMENTS:

For Ground Water Use Only
Temp. Blank 1 _____ °C
Temp. Blank 2 _____ °C

Relinquished by / Signature Wayne McCullock	Date/Time 8/19/13 1230	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	

Temp. Requirement

Where required, submitted samples were transported in coolers maintained at ≤ 6 °C.

Yes_____ No_____

Int_____

***Preservatives**

- *Hg, Metals (pH<2 - HNO3) (Clean metals check in section)
- *O&G (pH<2 - HCl, check in section) & store ≤ 6 °C
- CN^- (pH>12 - NaOH) & store ≤ 6 °C
- *Sulfide (pH>9 - NaOH+ZnAc) & store ≤ 6 °C
- *Micro ($Na_3S_2O_3$ + EDTA) & store < 10 °C
- *COD, NUT, Phenols (pH<2 - H_2SO_4) & store ≤ 6 °C
- *TOC (pH<2 - H_3PO_4) & store ≤ 6 °C
- *BOD, TSS, TVSS, Turbidity, Surfactant, Sulfate store ≤ 6 °C
- *NUT Non Acidified, Conductivity, Organics store ≤ 6 °C
- *Cr (VI) (pH 9.3 - 9.7 - $(NH_4)_2SO_4$) & store ≤ 6 °C

All sample(s) met proper *preservation requirements. Yes _____ No_____ Int _____

Sample Type: C=Composite, G=Grab Matrix: L= Liquid , S = Solid CGN: Container Group Number

NOTE: ALL APPLICABLE INFORMATION MUST BE COMPLETED PRIOR TO ACCEPTANCE.

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: FNE_TT1 TN-476-CONTROL
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	2.97	2.00	KWILLI	09/05/13	15:38
Others							
TSS	SM 2540 D	mg/L	<1.0	1.0	RCASTR	8/20/13	16:34
DOC	SM 5310C	mg/L	2.28	1.0	RMORGA	08/22/13	08:50
TOC	SM 5310C	mg/L	2.21	1.0	RMORGA	08/21/13	23:56

Authorization:_____ **Report Date:** _____
Lab Manager / QA Manager

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: FNE_TT2 / TN-476-40.8
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	36.9	0.50	KWILLI	08/23/13	13:22

Authorization:_____ **Report Date:** _____
Lab Manager / QA Manager

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: FNE_TT3 / TN-476-69.4
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	59.3	0.50	KWILLI	08/23/13	13:28

Authorization:_____
Lab Manager / QA Manager

Report Date: _____

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: FNE_TT4 / TN-476-118
Sample Date: 08/14/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	107	0.50	KWILLI	09/03/13	16:17

Authorization:_____
Lab Manager / QA Manager

Report Date: _____

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Composite Sample
Project Code: CM
Sample Point: FNE_C
Sample Date: 08/13/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Alkalinity	SM 2320 B	mg $CaCO_3$/L	257	30	AMOORE	08/16/13	08:30
Chloride	SM 4500-Cl B	mg/L	32	5	DRAIFO	08/20/13	07:59
DOC	SM 5310C	mg/L	2.20	1.0	RMORGA	08/21/13	23:20
TOC	SM 5310C	mg/L	2.22	1.0	RMORGA	08/21/13	21:49
Sulfate	ASTM D 516-07	mg/L	51.2	5.0	RMORGA	08/21/13	09:45
Sulfide	ASTM D 4658-08	mg/L	<0.10	0.10	RMORGA	08/14/13	06:49
Ammonia	Lachat 10-107-06-1-C	mg/L	<0.20	0.20	KSMITH	08/14/13	10:44
TKN	Lachat 10-107-06-2-I	mg/L	0.52	0.50	KSMITH	01/00/00	10:35
TSS	SM 2540 D	mg/L	<1.0	1.0	RCASTR	08/13/13	17:02
Hardness	SM 2340 B	mg $CaCO_3$/L	17.1	1.16	SLABOC	08/27/13	11:14
Dissolved Metals							
Copper	EPA 200.8	ug/L	2.55	0.50	KWILLI	08/20/13	17:04
Total Metals							
Copper	EPA 200.8	ug/L	2.71	0.50	KWILLI	08/21/13	12:07
Calcium	EPA 200.7	mg/L	5.48	0.30	SLABOC	08/27/13	11:14
Magnesium	EPA 200.7	mg/L	0.83	0.10	SLABOC	08/27/13	11:14
Sodium	EPA 200.7	mg/L	202	0.40	SLABOC	08/27/13	11:14
Potassium	EPA 200.7	mg/L	12.5	0.20	SLABOC	08/27/13	11:14

Notes
** Composite samples may be collected over more than one day. If applicable, refer to field records for duration of sampling event.*

Authorization: _____ **Report Date:** _____
Lab Manager / QA Manager

ATTACHMENT II

Report Quality Assurance Record
(2 pages)

REPORT QUALITY ASSURANCE RECORD

Client: Hampton Roads Sanitation District Project Number: 70005.08

Author: Wayne McCulloch EA Report Number: 6763

REPORT CHECKLIST

QA/QC ITEM	REVIEWER	DATE
1. Samples collected, transported, and received according to study plan requirements.	WMcCulloch	10/18/13
2. Samples prepared and processed according to study plan requirements.	WMcCulloch	10/18/13
3. Data collected using calibrated instruments and equipment.	WMcCulloch	10/18/13
4. Calculations checked:		
- Hand calculations checked	WMcCulloch	10/18/13
- Documented and verified statistical procedure used.	WMcCulloch	10/18/13
5. Data input/statistical analyses complete and correct.	R.A Connelly	10/28/13
6. Reported results and facts checked against original sources.	R.A. Connelly	10/28/13
7. Data presented in figures and tables correct and in agreement with text.	R.A. Connelly	10/28/13
8. Results reviewed for compliance with study plan requirements.	WMcCulloch	10/18/13

	AUTHOR	DATE
9. Commentary reviewed and resolved.	WMcCulloch	11/7/13

10. All study plan and quality assurance/control requirements have been met and the report is approved:

WMcCulloch	11/7/13
PROJECT MANAGER	DATE
R.A. Connelly	10/28/13
QUALITY CONTROL OFFICER	DATE
MKC	10/31/13
SENIOR TECHNICAL REVIEWER	DATE

Attachment 3

ROUND II OF COPPER WATER EFFECT RATIO (WER) TESTING FOR CENTRAL MIDDLESEX WWTP, VIRGINIA

Prepared for:

Hampton Roads Sanitation District
1436 Air Rail Ave.
Virginia Beach, VA 23455

Prepared by:

EA Engineering, Science, and Technology, Inc.
231 Schilling Circle
Hunt Valley, Maryland 21031
For questions concerning this report, please contact Wayne McCulloch
ph: 410-584-7000

Results relate only to the items tested or to the samples as received by the laboratory.

This report contains 11 pages plus 2 attachments.

Wayne L. McCulloch
Laboratory Director

21 November 2013
Date

VA Laboratory ID# 460159

ACCREDITED IN ACCORDANCE WITH nelac ID# E87550

EA Report Number 6797

1. INTRODUCTION

At the request of Hampton Roads Sanitation District (HRSD), EA Engineering, Science, and Technology, Inc. performed acute toxicity tests with *Ceriodaphnia dubia* (water flea), as the second round of testing for a copper water effect ratio (WER) study for the Central Middlesex WWTP, Virginia. Side-by-side tests were performed using 100 percent Central Middlesex WWTP final effluent as the test makeup water and a comparative test was performed using synthetic laboratory water with a similar hardness (12 mg/L hardness) as the final effluent for the test makeup water. The objective of this acute toxicity testing was to assess the acute lethality of copper, administered as cupric chloride ($CuCl_2 \cdot 2H_2O$) to *C. dubia* in final effluent versus a synthetic laboratory water to compare the toxicity of copper in the two different types of makeup water. The goal of the study was to calculate a copper water effect ratio (WER) for the Central Middlesex WWTP wastewater.

2. METHODS AND MATERIALS

2.1 SAMPLE DESCRIPTION

On 9-10 September 2013, a 24-hour composite sample of final effluent was collected from the Central Middlesex WWTP facility by Hampton Roads Sanitation District (HRSD) personnel. The sample was packed on wet ice, and sent via overnight carrier to EA's Ecotoxicology Laboratory in Hunt Valley, Maryland. Upon receipt at EA on 11 September, the sample was visually inspected, logged in, and assigned EA Aquatic Toxicology accession number AT3-513.

The Central Middlesex WWTP final effluent was used as the makeup water for the site water acute toxicity test. Alkalinity, hardness, and conductivity measurements were taken on the samples according to US EPA (1979) and APHA et al. (2005). These selected water quality parameters are summarized in Table 2. In addition to the final effluent sample, a synthetic laboratory dilution water with hardness value similar to the effluent (12 mg/L hardness) served as the dilution water for the side-by-side lab water acute toxicity tests. All samples were stored in the dark at 4°C when not in use.

2.2 TEST MATERIAL

The test article was copper, administered as reagent grade cupric chloride ($CuCl_2 \cdot 2H_2O$). Stock solutions of copper, dissolved in deionized water, were used to prepare the test concentrations.

2.3 TEST ORGANISMS

Ceriodaphnia dubia were cultured in EA's Culturing Facility in Hunt Valley, Maryland using moderately hard synthetic freshwater. The cultures were kept in an environmentally controlled room at 25±1°C with a 16-hour light/8-hour dark photoperiod. Organisms were fed daily as described in US EPA (2002) and thinned as necessary to maintain healthy, productive cultures. Gravid adults were re-isolated and fed 24 hours before test initiation to ensure that neonates were less than 24 hours old when used for testing. The neonates were fed prior to test initiation.

2.4 CULTURE WATER

Moderately hard synthetic freshwater US EPA (2002) was used as the culture water for the *C. dubia* acute toxicity tests. Batches of this water were made by passing deionized water through activated carbon and adding reagent grade chemicals per US EPA guidance (US EPA 2002), and aerating overnight. The water was stored at 25 °C under gentle aeration until needed.

2.5 WER DILUTION WATERS

The makeup waters for the Central Middlesex *C. dubia* site water acute toxicity test utilized 100 percent Central Middlesex WWTP final effluent. The final effluent sample had a harness of 12 mg/L. The synthetic dilution water for the lab water *C. dubia* toxicity test was prepared by adding reagent grade chemicals to carbon polished deionized water at a concentration to deliver a hardness value of 12 mg/L.

2.6 TOXICITY TEST OPERATIONS AND PERFORMANCE

The acute toxicity tests were performed in accordance with US EPA guidelines, and methodology followed EA's testing protocols (EA 2013). Prior to preparation of test solutions, aliquots of the final effluent and lab water were warmed to the desired test temperature of 25±1°C using a water bath. Test concentrations were prepared by spiking copper stock solutions into the appropriate dilution water. Each test solution was mixed and then split equally into the replicate test chambers. For the lab water test, the *C. dubia* were exposed to nominal concentrations of 0.6, 1.0, 1.7, 2.9, 4.9 and 8.3 µg/L Cu, with a corresponding laboratory water control. For the site water test, the nominal test concentration series was 8.3, 14.1, 24.0, 40.8, 69.4, 118 and 200.6 µg/L Cu, plus a 100 percent effluent control.

The 48-hour acute *C. dubia* tests were conducted in 30-ml plastic portion cups with 15 mls of test solution per cup. The less than 24 hour old *C. dubia* were loaded into the cups for a total of four replicates of five organisms per concentration. The *C. dubia* tests were conducted at 25±1°C with a

16-hour light/8-hour dark photoperiod. Water quality parameters (temperature, pH, dissolved oxygen, and conductivity) of test solutions were recorded daily on the test data sheets. Copies of the original data sheets, which include all water quality measurements and observations, are included in Attachment I.

Statistical analyses were performed according to US EPA guidance (2002) to determine the 48-hour median lethal concentrations (LC50s). The test data were analyzed using the ToxCalc statistical software package (Version 5.0, Tidepool Scientific Software). Chain-of-custody forms, raw data sheets, copies of statistical output and results of the chemical verification of copper test concentrations are included in Attachment I. The report Quality Assurance record is included in Attachment II.

2.7 REFERENCE TOXICANT TEST

In conformance with EA's quality assurance/quality control program, a monthly reference toxicant test was performed on the in-house cultured *C. dubia*. The *C. dubia* were exposed to a graded concentration series of the reference toxicant sodium chloride (NaCl) to determine the 48-hour LC50 value. The results were compared to the established control chart limits set by EA.

2.8 ARCHIVES

Original data sheets, records, memoranda, notes, and computer printouts are archived at EA's office in Hunt Valley, Maryland. The primary data and other related information will be retained for a period of 5 years unless HRSD requests a longer period of time.

3. RESULTS AND DISCUSSION

3.1 LAB WATER *Ceriodaphnia dubia* TOXICITY TEST

The results of the lab water (12 mg/L hardness) *Ceriodaphnia dubia* acute toxicity test, which was conducted side-by-side with the Central Middlesex WWTP final effluent test, are presented in Table 1. After 48 hours of exposure, there was 0, 85 and 95 percent survival in the 4.09, 2.37 and 1.75 µg/L measured total Cu test concentrations. There was 100 percent survival in the 1.03 µg/L measured total Cu test concentration and 100 percent survival in the laboratory control. For the 12 mg/L hardness laboratory water test, the *C. dubia* 48-hour LC50 value was 2.73 µg/L measured total Cu. The 95 percent confidence limits for the LC50 were 2.47-3.14 µg/L measured total Cu.

3.2 FINAL EFFLUENT *Ceriodaphnia dubia* TOXICITY TEST

The results of the Central Middlesex WWTP final effluent acute toxicity test with *C. dubia* are also presented in Table 1. After 48 hours of exposure, there was 0 percent survival in 172 µg/L measured total Cu test concentration. There was 100 percent survival in the 101 µg/L concentration and in the 100 percent Central Middlesex WWTP final effluent control. The resulting 48-hour *C. dubia* LC50 for the final effluent test was 131.8 µg/L measured total Cu. The 95 percent confidence limits for the LC50 were not calculable.

3.4 CALCULATION OF THE WATER EFFECTS RATIO

The water effect ratio (WER) is calculated as follows:

$$\text{WER} = \frac{\text{Final Effluent LC50}}{\text{Lab Water LC50}}$$

For the Central Middlesex final effluent, the WER for copper based on measured concentrations was 48.3.

3.5 REFERENCE TOXICANT TEST

In accordance with EA's quality control/quality assurance program, a reference toxicant test was conducted on the in-house cultured stock of *C. dubia* using sodium chloride (NaCl) as the reference toxicant. The 48-hour LC50 value for the September 2013 *C. dubia* test was 1,957 mg/L NaCl, which fell within EA's acceptable control chart limits of 1,620-2,128 mg/L NaCl (page 9).

4. REFERENCES

American Public Health Association, American Water Works Association, Water Environment Federation. 2012. Standard Methods for the Examination of Water and Wastewater. 22nd Edition. APHA, Washington, D.C.

EA. 2013. EA Ecotoxicology Laboratory Quality Assurance and Standard Operating Procedures Manual. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., Hunt Valley, Maryland.

US EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA/600/4-79/020. Environmental Protection Agency, Cincinnati, Ohio.

US EPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fifth Edition. EPA-821-R-02-012. U.S. Environmental Protection Agency, Office of Water, Washington, D. C.

SUMMARY OF SAMPLE/TEST INFORMATION

Test: ***Ceriodaphnia dubia* 48-hour static acute toxicity test**

Client Name: **Central Middlesex WWTP**

Test Procedure: **EA Protocol CD-AC-02**
Acute assay with *Ceriodaphnia dubia*

Final Effluent: **Central Middlesex Wastewater Treatment Plant, Virginia**

Laboratory Water Description: **Synthetic freshwater (12 mg/L hardness)**

Number of Replicates per Concentration: **4**

Number of Organisms per Replicate: **5**

Test Chamber: **30-ml cup**

Volume per Test Chamber: **15 ml**

Organism Lot Information

Lot Number: Not Applicable
Source: EA's Culture Facility (Hunt Valley, Maryland)
Age: <24 hours old

Reference Toxicant Test Information

Reference Toxicant: Sodium chloride (NaCl)
EA Test Number: RT-13-109
Dilution Water: Moderately hard synthetic freshwater
48-hour LC50: 1,957 mg/L NaCl
Laboratory control chart acceptability range for 48-hour LC50: 1,620-2,128 mg/L NaCl

TABLE 1 WER TESTING FOR CENTRAL MIDDLESEX WWTP, VIRGINIA

Sample Description:	**Lab Water (12 mg/L hardness)**		**Central Middlesex Final Effluent**
EA Sample Accession Number:	LD3-383		AT3-513
Sample collection dates:	NA		9/9/13-9/10/13
Sample receipt date:	NA		9/11/13
Test Organism:	***Ceriodaphnia dubia***		***Ceriodaphnia dubia***
EA Test Number:	**TN-13-534**		**TN-13-535**
Test Initiation and Date:	1510, 9/11/13		1523, 9/11/13
Test Termination and Date:	1524, 9/13/13		1530, 9/13/13
Test Concentration (µg/L Cu)	48-Hour Percent Survival	Test Concentration (µg/L Cu)	48-Hour Percent Survival
Control [<0.5][a]	100	Control [2.84]	100
0.6	100	8.3	100
1.0 [1.03]	100	14.1	100
1.7 [1.75]	95	24.0	100
2.9 [2.37]	85	40.8	100
4.9 [4.09]	0	69.4	100
8.3	0	118.0 [101]	100
		200.6 [172]	0
48-Hour LC50[b] (µg/L Cu):	**2.73 (2.47-3.14)[c]**		**131.8 (NC)[d]** **WER 48.3**
Selected Test Water Quality			
Temperature (°C):	24.0 – 24.8		24.0 – 24.6
pH:	7.4 – 8.1		8.4 – 8.8
Dissolved Oxygen (mg/L):	6.1 – 8.7		7.1 – 8.8
Conductivity (µS/cm):	54 – 78		794 – 1,005

(a) Measured total copper values in brackets.
(b) LC50 calculation based on measured total copper concentrations.
(c) Values in parentheses are 95 percent confidence limits.
(d) 95 percent confidence limits were not calculable.

TABLE 2 SUMMARY OF WATER QUALITY PARAMETERS MEASURED UPON RECEIPT OF SEPTEMBER 2013 SAMPLES FROM CENTRAL MIDDLESEX WWTP

Accession Number	Temperature (°C)	pH	TRC (mg/L)	Alkalinity (mg/L)	Hardness (mg/L)	Conductivity (µS/cm)	TSS (mg/L)	TOC (mg/L)	DOC (mg/L)
Central Middlesex Final Effluent:									
AT3-513	1.0	8.7	<0.01	268	12	986	<1.0	2.61	2.53
Lab Water:									
LD3-383	NA	NA	NA	16	12	66	<1.0	<1.0	<1.0

ATTACHMENT I

Data Sheets and Statistical Analyses
(29 pages)

Chain-of-Custody Record

EA Engineering, Science, and Technology

EA Ecotoxicology Laboratory
231 Schilling Circle
Hunt Valley, Maryland 21031
Telephone: 410-584-7000
Fax: 410-584-1057

Sample Shipped By: (circle)
(Fed. Ex) UPS Other: _____
Tracking #: 7966 0588 3068

Client: HRSD Project No.: _____

NPDES Number: _____ Client Purchase Order Number: _____

City/State Collected: Saluda, VA

PLEASE READ SAMPLING INSTRUCTIONS ON BACK OF FORM

Accession Number (office use only)	Grab	Composite	Collection Start Date/Time	Collection End Date/Time	Sample Description (including Site, Station Number, and Outfall Number)	Number/Volume of Container
AT3-573		✓	091013/0941	091013/0941	Central Middlesex WWTP FNE	2/1Gal

Sampled By:	Date/Time	Received By:	Date/Time
Bertsch	091013/0941		
Sampler's Printed Name:	Title:	Relinquished By:	Date/Time
Molly Bertsch	WQ Technician		
Relinquished By:	Date/Time	Received By Laboratory	Date/Time
M. Bertsch	091013/0950		9/11/13 1010

Was Sample Chilled During Collection? (Yes) / No

Comments:

Sample Collection Parameters

Visual Description: No visible particulates
Temperature (°C): 11.8
pH: 8.58
TRC (mg/L): 0.0
Other:

White-Report Production Yellow-Laboratory Pink-Client/Sampler

SAMPLE CHECK-IN FOR TESTING

Client: HRSD

EA Accession Number: AT3-573

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	1.0	9/11/13	1010	CH
Is ice present?	---	yes	✓	✓	✓
pH	6.0-9.0	8.7			
TRC (mg/L)	<0.01	<0.01			
Visual Description	---	slight yellow	✓	✓	✓

***If outside acceptable range, contact project manager.**

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✓)	Date	Time	Initials
Ammonia (preserve aliquot)	--				
Parameter	**Acceptable Range**	**Measurement***	**Date**	**Time**	**Initials**
Salinity (ppt)	--				

TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN - 13-534

TEST ORGANISM INFORMATION

Common Name: Water flea
Scientific Name: Ceriodaphnia dubia
Lot Number: N/A
Source: EA

Adults Isolated (Time, Date): 0907 9/11/13
Neonates Pulled & Fed (Time, Date): 1150 9/11/13
Acclimation: <24hrs Age: <24hrs
Culture Water (T/S): 25.1 °C 0 ppt

TEST INITIATION

Date	Time	Initials	Activity
9/11/13	1305	CH	Dilutions Made
↓	1305	CH	Test Vessels Filled
	1510	CH	Organisms Transferred
↓	1530	VM	Head Counts

TEST SET-UP

Sample Number: COPPER STOCK (B) = 1,000µg/L = 1 µg/ml Cu (SP3-045)
STOCK (C) = 100µg/L = 0.1µg/ml Cu (SP3-046)

Dilution Number: LD3-383

µg/L Cu

Test Concentration	Volume Test Material	Final Volume
LAB CONTROL		
→ 0.6	1.8mls STOCK (C)	300mls
1	3mls STOCK (C)	
1.7	5.1mls (C)	
2.9	8.7mls (C)	
4.9	14.7mls (C)	
8.3	2.5mls (B)	

HRSD - WER (Copper)

Copper Chloride Stocks - $CuCl_2 \cdot 2H_2O$ (FW 170.48)

Stock (A) 0.1 g/L = 100 µg/ml — 0.268g $CuCl_2 \cdot 2H_2O$ → 1,000ml D.I H_2O

Stock (B) 1,000 µg/L = 1.0 µg/ml — 10ml Stock (A) → 1,000ml vol w/ D.I H_2O

Stock (C) 100 µg/L = 0.1 µg/ml — 50ml Stock (B) → 500ml vol w/ D.I H_2O

Concentration	Vol Cu Stock		Total Vol
Control 0.6 µg/L Cu	1.8ml	Stock (C)	300ml
1 µg/L Cu	3ml	Stock (C)	
1.7	5.1ml	(C)	
2.9	8.7ml	(C)	
4.9	14.7ml	(C)	
8.3	2.5ml	(B)	
14.1	4.2ml	(B)	
24	7.2ml	(B)	
40.8	12.2ml	(B)	
69.4	20.8ml	(B)	
118	35.4ml	(B)	
200.6	60.2ml	(B)	

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN-13-534
Test Material: COPPER
Accession Number: SP3-045/046
Dilution Water: Soft H_2O
Accession Number: AT3-383
LD3 –
WSM 11/6/13

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥ 4.0 mg/L
pH: 6.0 - 9.0 Salinity: ø ppt
Photoperiod: 16 l, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 9/11/13 Time: 1510
Ending Date: 9/13/13 Time: 1524
TEST TYPE: (Static) / Flowthrough
Renewal / (Non-renewal)
Test Container: 30ml cup
Test Volume: 15mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
LAB CONTROL	A	5	5	5			24.2	24.0	24.0			8.1	7.9	7.7			6.4	8.2	7.8			65.5	72.3	78.0		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
0.6	A	5	5	5			24.2	24.6	24.0			8.0	7.8	7.6			6.5	8.3	7.8			57.2	58.6	61.2		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
1.0	A	5	5	5			24.1	24.7	24.1			7.9	7.7	7.5			6.3	8.6	7.7			56.7	58.0	59.8		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
Meter Number							675	677	677			675	677	677			675	677	677			675	677	677		
Time		1530	1427	1524			1310	0927	0854			1310	0927	0854			1310	0927	0854			1310	0927	0854		
Initials		MJ	MJ	MJ			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0 Americamysis: 2007.0 Menidia:2006.0
Magna/pulex: 2021.0 Trout: 2019.0 Cyprinodon: 2004.0 OTHER:

12/02/08
ATS-T01

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN-13-534
Test Material: COPPER
Accession Number: SP3-045/046
Dilution Water: Soft H_2O
Accession Number: LP3-383

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥ 4.0 mg/L
pH: 6.0 - 9.0 Salinity: ∅ ppt
Photoperiod: 16 ℓ, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 9/11/13 Time: 1570
Ending Date: 9/13/13 Time: 1524
TEST TYPE: (Static) / Flowthrough
Renewal / (Non-renewal)
Test Container: 30ml cup
Test Volume: 15mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
1.7	A	5	5	5			24.0	24.8	24.2			7.8	7.7	7.4			6.3	8.7	7.8			56.0	57.3	59.1		
	B	5	5	4																						
	C	5	5	5																						
	D	5	5	5																						
2.9	A	5	4	4			24.0	24.8	24.2			7.8	7.6	7.5			6.4	8.6	7.7			55.2	56.4	58.2		
	B	5	5	3																						
	C	5	5	5																						
	D	5	5	5																						
4.9	A	5	0	0			24.0	24.8				7.7	7.6				6.7	8.5				54.1	55.5			
	B	5	0	0																						
	C	5	0	0																						
	D	5	0	0																						
Meter Number							675	677	677			675	677	677			675	677	677			675	677	677		
Time		1530	1427	1524			1310	0927	0854			1310	0927	0854			1310	0927	0854			1310	0927	0854		
Initials		VM	MJ	MJ			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead: 2000.0 _____ Americamysis: 2007.0 _____ Menidia: 2006.0 _____
Magna/pulex: 2021.0 _____ Trout: 2019.0 _____ Cyprinodon: 2004.0 _____ OTHER: _____

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN-13-534
Test Material: COPPER
Accession Number: SP3-045/046
Dilution Water: Soft H_2O
Accession Number: LD3-383

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥ 4.0 mg/L
pH: 6.0 - 9.0 Salinity: ∅ ppt
Photoperiod: 16 ℓ. 8 d Light Intensity: 50 - 100 fc

Beginning Date: 9/11/13 Time: 1510
Ending Date: 9/13/13 Time: 1524
TEST TYPE: (Static) / Flowthrough
Renewal / (Non-renewal)
Test Container: 30ml cup
Test Volume: 15mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms					Temperature (°C)					pH					Dissolved Oxygen (mg/L)					Conductivity (µS/cm) ~~Salinity (ppt)~~				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
8.3	A	5	0	0			24.0	24.7	—			7.7	7.5	—			6.1	8.6	—			56.3	57.5	—		
	B	5	0	0																						
	C	5	0	0																						
	D	5	0	0																						
Meter Number							675	677				675	677				675	677				675	677			
Time		1530	1427	1524			1310	0927				1310	0927				1310	0927				1310	0927			
Initials		VY	MJ	MJ			CH	MJ				CH	MJ				CH	MJ				CH	MJ			

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead: 2000.0 _____ Americamysis: 2007.0 _____ Menidia: 2006.0 _____
Magna/pulex: 2021.0 _____ Trout: 2019.0 _____ Cyprinodon: 2004.0 _____ OTHER: _____

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005

Client: HRSD/Central Middlesex

QC Test Number: TN-13-534

Date/Time/Initials	Comments/Activity

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005.08
Client: HRSD-/Central Middlesex
QC Test Number: TN-13-534

Aliquot of sample warmed to test temperature, then aerated if supersaturated:

		ON AIR			OFF AIR		
Date	Sample #	Initial DO (mg/L)	Time	Initials	Final DO (mg/L)	Time	Initials
9/11/13	AT3-513	9.1	1050	CH	8.4	1100	CH

HRSD
Cleaning wastewater every day for a better Bay.

CENTRAL ENVIRONMENTAL LABORATORY
1432 AIR RAIL AVENUE
VIRGINIA BEACH, VA 23455
TEL: 757-460-4214
FAX: 757-460-6586

CHAIN OF CUSTODY

PROJECT NAME/CODE: Central Middlesex Plant

ANALYSES REQUESTED, CGN & NUMBER OF CONTAINERS

Project in Lims? Yes __x__ No _____

CUSTOMER SAMPLE ID	HRSD Use Only: PROJECT CODE	HRSD Use Only: SAMPLE POINT	DATE	TIME	SAMPLED BY	Circle One: MATRIX	Circle One: SAMPLE TYPE	TSS (1)	TOTAL METALS (5)	DOC (61)	TOC (29)				HRSD Use Only: Presv'd Checked	HRSD Use Only: CONT. COUNT
CONTROL	CM	CM CTRL_TT1	9/16/13	1250	WM	L	G	1	1	1	1					
TN-534 (1.0)	CM	CM CTRL_TT2	9/16/13	1250		L	G		1							
TN-534 (2.7)	CM	CM CTRL_TT3	9/16/13	1250		L	G		1							
TN-534 (3.9)	CM	CM CTRL_TT4	9/16/13	1250		L	G		1							
TN-534 (4.9)	CM	CM CTRL_TT5	9/16/13	1250	↓	L	G		1							

COMMENTS:

For Ground Water Use Only
Temp. Blank 1 - °C
Temp. Blank 2 - °C

Relinquished by / Signature Wayne McCullock	Date/Time 9/16/13 1400	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	

Temp. Requirement

Where required, submitted samples were transported in coolers maintained at ≤ 6 °C.

Yes_____ No_____

Int_____

***Preservatives**

- *Hg, Metals (pH<2 - HNO3) (Clean metals check in section)
- *O&G (pH<2 - HCl, check in section) & store ≤ 6 °C
- CN^- (pH>12 - NaOH) & store ≤ 6 °C
- *Sulfide (pH>9 - NaOH+ZnAc) & store ≤ 6 °C
- *Micro ($Na_3S_2O_3$ + EDTA) & store < 10 °C
- *COD, NUT, Phenols (pH<2 - H_2SO_4) & store ≤ 6 °C
- *TOC (pH<2 - H_3PO_4) & store ≤ 6 °C
- *BOD, TSS, TVSS, Turbidity, Surfactant, Sulfate store ≤ 6 °C
- *NUT Non Acidified, Conductivity, Organics store ≤ 6 °C
- *Cr (VI) (pH 9.3 - 9.7 - $(NH_4)_2SO_4$) & store ≤ 6 °C

All sample(s) met proper *preservation requirements. Yes _____ No_____ Int _____

Sample Type: C=Composite, G=Grab Matrix: L= Liquid , S = Solid CGN: Container Group Number

NOTE: ALL APPLICABLE INFORMATION MUST BE COMPLETED PRIOR TO ACCEPTANCE.

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT1
Sample Date: 09/16/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	<0.50	0.50	KWILLI	09/23/13	10:58
Others							
TSS	SM 2540 D	mg/L	<1.0	1.0	RCASTR	09/17/13	16:00
DOC	SM 5310C	mg/L	<1.00	1.00	JRICKS	09/18/13	18:20
TOC	SM 5310C	mg/L	<1.00	1.00	JRICKS	09/18/13	17:57

Authorization:_____ **Report Date:** _____
Lab Manager / QA Manager

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT2
Sample Date:

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	1.03	0.50	KWILLI	09/23/13	11:10

Authorization: _____
Lab Manager / QA Manager

Report Date: _____

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT3
Sample Date:

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	1.75	0.50	KWILLI	09/23/13	11:14

Authorization:_____
Lab Manager / QA Manager

Report Date: _____

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT4
Sample Date:

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	2.37	0.50	KWILLI	09/23/13	11:18

Authorization:_____
Lab Manager / QA Manager

Report Date: _____

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: CTRL_TT5
Sample Date:

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	4.09	0.50	KWILLI	09/23/13	11:22

Authorization:_____ **Report Date:** _____
Lab Manager / QA Manager

Acute Toxicity Test-48 Hr Survival

Start Date:	9/11/2013	Test ID:	TN-13-534	Sample ID:	HRSD Copper WER II
End Date:	9/13/2013	Lab ID:		Sample Type:	Lab Water
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-mg/L	1	2	3	4
Control	1.0000	1.0000	1.0000	1.0000
1.03	1.0000	1.0000	1.0000	1.0000
1.75	1.0000	0.8000	1.0000	1.0000
2.37	0.8000	0.6000	1.0000	1.0000
4.09	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			0	20
1.03	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
1.75	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4	16.00	10.00	1	20
2.37	0.8500	0.8500	1.1709	0.8861	1.3453	18.840	4	14.00	10.00	3	20
4.09	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

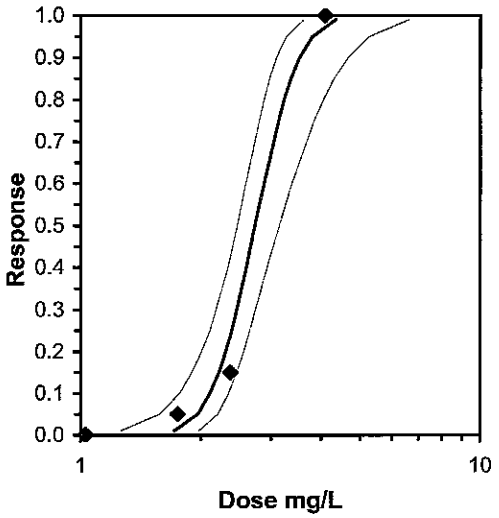
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.84669	0.844	-0.9648	2.2854
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	2.37	4.09	3.11341	

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	11.5028	2.46445	6.67246	16.3331	0	3.45088	5.99146	0.18	0.43667	0.08694	7
Intercept	-0.023	1.0197	-2.0216	1.97566							
TSCR											

Point	Probits	mg/L	95% Fiducial Limits	
EC01	2.674	1.71566	1.26308	1.9791
EC05	3.355	1.96642	1.57745	2.207
EC10	3.718	2.11476	1.76746	2.35019
EC15	3.964	2.22111	1.90224	2.45996
EC20	4.158	2.30944	2.01144	2.55747
EC25	4.326	2.38801	2.10534	2.65019
EC40	4.747	2.59805	2.33617	2.93086
EC50	5.000	2.73321	2.46811	3.13773
EC60	5.253	2.8754	2.59492	3.37549
EC75	5.674	3.12831	2.79867	3.8407
EC80	5.842	3.23474	2.87857	4.05009
EC85	6.036	3.36338	2.97186	4.31258
EC90	6.282	3.53253	3.09021	4.6722
EC95	6.645	3.799	3.26916	5.26943
EC99	7.326	4.35427	3.62185	6.62415



Reviewed by: 11/5/13

535

TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN - 13 - 535

TEST ORGANISM INFORMATION

Common Name: Water flea
Scientific Name: Ceriodaphnia dubia
Lot Number: N/A
Source: EA

Adults Isolated (Time, Date): 0905 9/11/13
Neonates Pulled & Fed (Time, Date): 1205 9/11/13
Acclimation: <24hrs Age: <24hrs
Culture Water (T/S): 25.1 °C Ø ppt

TEST INITIATION

Date	Time	Initials	Activity
9/11/13	1330	CH	Dilutions Made
↓	1330	CH	Test Vessels Filled
	1523	VM	Organisms Transferred
↓	1530	CH	Head Counts

TEST SET-UP

Sample Number: COPPER STOCK (B) = 1,000µg/L = 1µg/ml Cu (SP3-045)
STOCK (C) = 100µg/L = 0.1µg/ml Cu
Dilution Number: AT3-573

Test Concentration	Volume Test Material	Final Volume
Effluent Control	—	300 mls
8.3	2.5mls Stock (B)	↓
14.1	4.2mls Stock (B)	
24	7.2mls	
40.8	12.2mls	
69.4	20.8mls	
118	35.4mls	
200.6	60.2mls	

HRSD - WER (Copper)

Copper Chloride Stocks - $CuCl_2 \cdot 2H_2O$ (FW 170.48)

Stock (A) 0.1 g/L = 100 µg/ml — 0.268 g $CuCl_2 \cdot 2H_2O$ → 1,000 ml D.I H_2O

Stock (B) 1,000 µg/L = 1.0 µg/ml — 10 ml Stock (A) → 1,000 ml vol w/ D.I H_2O

Stock (C) 100 µg/L = 0.1 µg/ml — 50 ml Stock (B) → 500 ml vol w/ D.I H_2O

Concentration	Vol Cu Stock		Total Vol
Control	—		300 ml
1 µg/L Cu	3 ml	Stock (C)	
1.7	5.1 ml	(C)	
2.9	8.7 ml	(C)	
4.9	14.7 ml	(C)	
8.3	2.5 ml	(B)	
14.1	4.2 ml	(B)	
24	7.2 ml	(B)	
40.8	12.2 ml	(B)	
69.4	20.8 ml	(B)	
118	35.4 ml	(B)	
200.6	60.2 ml	(B)	

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN-13-535
Test Material: COPPER
Accession Number: SP3-045
Dilution Water: Effluent
Accession Number: AT3-573

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥ 4.0 mg/L
pH: 6.0 - 9.0 Salinity: ∅ ppt
Photoperiod: 16 ℓ, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 9/11/13 Time: 1523
Ending Date: 9/13/13 Time: 1530
TEST TYPE: (Static) / Flowthrough
Renewal / (Non-renewal)
Test Container: 30ml cup
Test Volume: 15mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms 0	24	48	72	96	Temperature (°C) 0	24	48	72	96	pH 0	24	48	72	96	Dissolved Oxygen (mg/L) 0	24	48	72	96	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	24	48	72	96
EFFLUENT	A	5	5	5			24.1	24.1	24.0			8.6	8.8	8.4			7.6	8.6	7.7			966	991	1002		
CONTROL	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
8.3	A	5	5	5			24.2	24.3	24.0			8.6	8.8	8.5			7.6	8.5	7.6			968	978	1003		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
14.1	A	5	5	5			24.1	24.5	24.1			8.6	8.8	8.5			7.5	8.5	7.4			967	980	1005		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
Meter Number							675	677	677			675	677	677			675	677	677			675	677	677		
Time		1530	1423	1530			1335	0917	0856			1335	0917	0856			1335	0917	0856			1335	0917	0856		
Initials		CH	MJ	MJ			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0 ____ Americamysis: 2007.0 ____ Menidia:2006.0 ____
Magna/pulex: 2021.0 ____ Trout: 2019.0 ____ Cyprinodon: 2004.0 ____ OTHER: ____

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN-13-535
Test Material: COPPER
Accession Number: SP3-045
Dilution Water: Effluent
Accession Number: AT3-573

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥ 4.0 mg/L
pH: 6.0 - 9.0 Salinity: ∅ ppt
Photoperiod: 16 ℓ, 8 d Light Intensity: 50 - 100 fc

Beginning Date: 9/11/13 Time: 1523
Ending Date: 9/13/13 Time: 1530
TEST TYPE: (Static) / Flowthrough
Renewal / (Non-renewal)
Test Container: 30ml cup
Test Volume: 15mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms 0	24	48	72	96	Temperature (°C) 0	24	48	72	96	pH 0	24	48	72	96	Dissolved Oxygen (mg/L) 0	24	48	72	96	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	24	48	72	96
24	A	5	5	5			24.1	24.6	24.2			8.6	8.8	8.6			7.3	8.4	~~7.9~~			957	970	993		
	B	5	5	5															7.4							
	C	5	5	5																						
	D	5	5	5																						
40.8	A	5	5	5			24.1	24.6	24.4			8.6	8.8	8.6			7.6	8.6	7.3			942	950	993		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
69.4	A	5	5	5			24.1	24.6	24.4			8.6	8.8	8.4			~~7.4~~	8.7	7.4			915	930	~~993~~		
	B	5	5	5																				953		
	C	5	5	5																						
	D	5	5	5			675																			
Meter Number							~~677~~	677	677			675	677	677			675	677	677			675	677	677		
Time		1530	1423	1530			1335	0917	0856			1335	0917	0856			1335	0917	0856			1335	0917	0856		
Initials		CH	MJ	MJ			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH		

CH 9/11 — 9/13 CH — 9/13 CH

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0_____ Americamysis: 2007.0_____ Menidia:2006.0_____
Magna/pulex: 2021.0_____ Trout: 2019.0_____ Cyprinodon: 2004.0_____ OTHER: _____

ACUTE TOXICITY TEST DATA SHEET

Project Number: 70005.08
Client: HRSD / Central Middlesex
QC Test Number: TN-13-535
Test Material: COPPER
Accession Number: SP3-045
Dilution Water: Effluent
Accession Number: ATS-573

TEST ORGANISM
Common Name: Water flea
Scientific Name: Ceriodaphnia dubia

TARGET VALUES
Temp: 25±1 °C DO: ≥ 4.0 mg/L
pH: 6.0 - 9.0 Salinity: Ø ppt
Photoperiod: 16 L 8 d Light Intensity: 50 - 100 fc

Beginning Date: 9/11/13 Time: 1523
Ending Date: 9/13/13 Time: 1530
TEST TYPE: (Static) / Flowthrough
Renewal / (Non-renewal)
Test Container: 30ml cup
Test Volume: 15mls
Test Duration: 48 hours

µg/L Cu Concentration	Rep	Number of Live Organisms 0	24	48	72	96	Temperature (°C) 0	24	48	72	96	pH 0	24	48	72	96	Dissolved Oxygen (mg/L) 0	24	48	72	96	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	24	48	72	96
118	A	5	5	5			24.1	24.4	24.5			8.6	8.7	8.6			7.4	8.8	7.1			870	885	809		
	B	5	5	5																						
	C	5	5	5																						
	D	5	5	5																						
200.6	A	5	0	0			24.1	24.5	—			8.6	8.7	—			7.5	8.7	—			794	810	—		
	B	5	0	0																						
	C	5	0	0																						
	D	5	0	0																						
Meter Number							675	677	677			675	677	677			675	677	677			675	677	677		
Time		1530	1423	1530			1335	0917	0856			1335	0917	0856			1335	0917	0856			1335	0917	0856		
Initials		CH	MJ	MJ			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH			CH	MJ	CH		

EPA Test Method: EPA 821-R-02-012 (CHECK ONE)

Ceriodaphnia: 2002.0 ✓ Fathead:2000.0_____ Americamysis: 2007.0_____ Menidia:2006.0_____
Magna/pulex: 2021.0_____ Trout: 2019.0_____ Cyprinodon: 2004.0_____ OTHER: _____

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005.08
Client: HRSD-/Central Middlesex
QC Test Number: TN-13-535

Aliquot of sample warmed to test temperature, then aerated if supersaturated:

Date	Sample #	ON AIR			OFF AIR		
		Initial DO (mg/L)	Time	Initials	Final DO (mg/L)	Time	Initials

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70005

Client: HRSD/Central Middlesex

QC Test Number: TN-13-535

Date/Time/Initials	Comments/Activity

HRSD
Cleaning wastewater every day for a better Bay.

CENTRAL ENVIRONMENTAL LABORATORY
1432 AIR RAIL AVENUE
VIRGINIA BEACH, VA 23455
TEL: 757-460-4214
FAX: 757-460-6586

CHAIN OF CUSTODY

PROJECT NAME/CODE: Central Middlesex Plant

CUSTOMER SAMPLE ID	HRSD Use Only: PROJECT CODE	HRSD Use Only: SAMPLE POINT	DATE	TIME	SAMPLED BY	Circle One: MATRIX	Circle One: SAMPLE TYPE	ANALYSES REQUESTED, CGN & NUMBER OF CONTAINERS: TSS (1)	TOTAL METALS (5)	DOC (61)	TOC (29)				Project in Lims? Yes __x__ No _____ HRSD Use Only: Presv'd Checked	CONT. COUNT
Control TN-535	CM	CM FNE_TT1	9/16/13	1300	WM	L	G	1	1	1	1					
TN-535 (118)	CM	CM FNE_TT2	9/16/13	1300	WM	L	G		1							
TN-535 (200.6)	CM	CM FNE_TT3	9/16/13	1300	WM	L	G		1							
	CM	CM FNE_TT4				L	G		1							
	CM	CM FNE_TT5				L	G		1							

COMMENTS:

For Ground Water Use Only
Temp. Blank 1 _____ °C
Temp. Blank 2 _____ °C

Relinquished by / Signature: Wayne M Tillock	Date/Time: 9/16/13 1400	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	
Relinquished by / Signature	Date/Time	
Received by / Signature	Date/Time	

Temp. Requirement

Where required, submitted samples were transported in coolers maintained at ≤ 6 °C.

Yes_____ No_____

Int_____

***Preservatives**

- *Hg, Metals (pH<2 - HNO3) (Clean metals check in section)
- *O&G (pH<2 - HCl, check in section) & store ≤ 6 °C
- CN^- (pH>12 - NaOH) & store ≤ 6 °C
- *Sulfide (pH>9 - NaOH+ZnAc) & store ≤ 6 °C
- *Micro ($Na_2S_2O_3$ + EDTA) & store < 10 °C
- *COD, NUT, Phenols (pH<2 - H_2SO_4) & store ≤ 6 °C
- *TOC (pH<2 - H_3PO_4) & store ≤ 6 °C
- *BOD, TSS, TVSS, Turbidity, Surfactant, Sulfate store ≤ 6 °C
- *NUT Non Acidified, Conductivity, Organics store ≤ 6 °C
- *Cr (VI) (pH 9.3 - 9.7 - $(NH_4)_2SO_4$) & store ≤ 6 °C

All sample(s) met proper *preservation requirements. Yes _____ No_____ Int _____

Sample Type: C=Composite, G=Grab Matrix: L= Liquid , S = Solid CGN: Container Group Number

NOTE: ALL APPLICABLE INFORMATION MUST BE COMPLETED PRIOR TO ACCEPTANCE.

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: FNE_TT1
Sample Date: 09/16/13

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	2.84	0.50	KWILLI	09/23/13	11:26
Others							
TSS	SM 2540 D	mg/L	<1.0	1.0	RCASTR	09/17/13	16:00
DOC	SM 5310C	mg/L	2.53	1.00	JRICKS	09/18/13	16:58
TOC	SM 5310C	mg/L	2.61	1.00	JRICKS	09/18/13	17:35

Authorization:_____ **Report Date:** _____
Lab Manager / QA Manager

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: FNE_TT2
Sample Date:

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	101	0.50	KWILLI	09/23/13	11:38

Authorization:_____ **Report Date:** _____
Lab Manager / QA Manager

ANALYTICAL REPORT

Project Description: Central Middlesex Plant - Toxicity Tests
Project Code: CM
Sample Point: FNE_TT3
Sample Date:

Test Code	Method	Unit	Result	Report Limit	Analyst	Analytical Date	Analytical Time
Total Metals							
Copper	EPA 200.8	ug/L	172	0.50	KWILLI	09/23/13	11:43

Authorization:_____
Lab Manager / QA Manager

Report Date: _____

Acute Toxicity Test-48 Hr Survival

Start Date:	9/11/2013	Test ID:	TN-13-535	Sample ID:	HRSD Copper WER II
End Date:	9/13/2013	Lab ID:		Sample Type:	Final Effluent
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	CD-Ceriodaphnia dubia
Comments:					

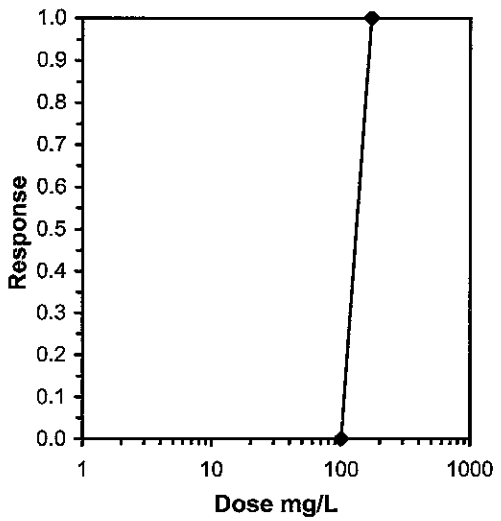
Conc-mg/L	1	2	3	4
Control	1.0000	1.0000	1.0000	1.0000
101	1.0000	1.0000	1.0000	1.0000
172	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Number	Total
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Resp	Number
Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0	20
101	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	0	20
172	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4	20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	1	0.749		
Equality of variance cannot be confirmed				

Graphical Method

Trim Level	EC50
0.0%	131.80
	131.80



ToxCalc v5.0.23

Reviewed by: 11/5/13

ATTACHMENT II

Report Quality Assurance Record
(2 pages)

REPORT QUALITY ASSURANCE RECORD

Client: HRSD/Central Middlesex | Project Number: 70005.08

Author: Wayne McCulloch | EA Report Number: 6794

REPORT CHECKLIST

QA/QC ITEM	REVIEWER	DATE
1. Samples collected, transported, and received according to study plan requirements.	W McCulloch	10/24/13
2. Samples prepared and processed according to study plan requirements.	W McCulloch	10/24/13
3. Data collected using calibrated instruments and equipment.	W McCulloch	10/24/13
4. Calculations checked:		
- Hand calculations checked	W McCulloch	10/24/13
- Documented and verified statistical procedure used.	W McCulloch	10/24/13
5. Data input/statistical analyses complete and correct.	R. A. Connelly	11/5/13
6. Reported results and facts checked against original sources.	R. A. Connelly	11/5/13
7. Data presented in figures and tables correct and in agreement with text.	R. A. Connelly	11/5/13
8. Results reviewed for compliance with study plan requirements.	W McCulloch	10/24/13

	AUTHOR	DATE
9. Commentary reviewed and resolved.	W McCulloch	11/21/13

10. All study plan and quality assurance/control requirements have been met and the report is approved:

W McCulloch	11/21/13
PROJECT MANAGER	DATE
R. A. Connelly	11/5/13
QUALITY CONTROL OFFICER	DATE
[signature]	11/15/13
SENIOR TECHNICAL REVIEWER	DATE

Attachment I: Monitoring Frequency Reduction Analysis

Monitoring Frequency Reduction Analysis - Outfall 001

Outfall 001 DMR Due Date	$cBOD_5$ (mg/L) MO AVG	TSS (mg/L) MO AVG	Fecal Coliform (MPN/100ml) DAILY MAX	Ammonia (mg/L) MO AVG	TKN (mg/L) MO AVG	*E. coli* Geometric Mean (MPN/100 ml) MO AVG	DO (mg/L) MIN	pH (SU) MIN	pH (SU) MAX
10-Jul-12	<QL	4.3	4	<QL	1.1	1	7.6	8	8.9
10-Aug-12	<QL	3	1	<QL	1.1	1	7.2	8.1	8.6
10-Sep-12	<QL	<QL	1	<QL	<QL	1	7.3	8.2	8.7
10-Oct-12	<QL	1	1	<QL	0.53	1	7.2	8	8.8
10-Nov-12	<QL	<QL	1	<QL	<QL	1	7.1	8.2	8.8
10-Dec-12	<QL	<QL	1	<QL	0.6	1	8.3	7.4	8.6
10-Jan-13	<QL	<QL	1	<QL	<QL	1	9.6	8.2	8.7
10-Feb-13	<QL	<QL	1	0.25	0.94	1	9.3	8.2	8.6
10-Mar-13	<QL	<QL	1	<QL	0.89	1	9.5	8.2	8.7
10-Apr-13	<QL	<QL	1	<QL	0.6	1	9.6	8.2	8.7
10-May-13	<QL	4.1	1	<QL	0.68	1	7.4	8	8.6
10-Jun-13	<QL	1.2	1	<QL	0.69	1	7.7	8.2	8.7
10-Jul-13	<QL	1.9	3	<QL	0.96	1	7	7.7	8.5
10-Aug-13	<QL	<QL	1	<QL	0.77	1	6.6	7.6	8.5
10-Sep-13	<QL	<QL	1	<QL	<QL	1	7.1	8.1	8.7
10-Oct-13	<QL	<QL	1	<QL	0.58	1	7	7.6	8.6
10-Nov-13	<QL	<QL	1	<QL	<QL	1	7.6	7.7	8.6
10-Dec-13	<QL	2	1	<QL	<QL	1	8.3	8	8.5
10-Jan-14	<QL	1	1	<QL	<QL	1	8.8	8	8.5
10-Feb-14	<QL	1.1	1	<QL	0.55	1	9.8	7.9	8.6
10-Mar-14	<QL	<QL	1	<QL	<QL	1	9.4	8	8.4
10-Apr-14	<QL	<QL	1	<QL	0.63	1	10	7.2	8.3
10-May-14	<QL	<QL	1	<QL	0.71	1	8.9	7	8.4
10-Jun-14	<QL	5	1	<QL	1	1	8	7.5	8.5
10-Jul-14	<QL	4.1	1	<QL	0.86	1	7.9	7.9	8.6
10-Aug-14	<QL	<QL	1	<QL	0.6	1	7.4	8	8.6
10-Sep-14	<QL	<QL	1	<QL	1.1	2	7.5	7.6	8.6
10-Oct-14	<QL	<QL	1	<QL	0.96	1	7.2	7.3	8.5
10-Nov-14	<QL	1.6	1	<QL	0.79	1	6.5	7.2	8.3
10-Dec-14	<QL	<QL	1	<QL	0.68	1	8.5	7.1	8.8
10-Jan-15	<QL	<QL	1	<QL	0.52	1	10	7.3	8.4
10-Feb-15	<QL	1	1	<QL	0.86	1	10.4	6.8	8.4
10-Mar-15	<QL	<QL	1	<QL	0.86	1	10	7.2	8.4
10-Apr-15	<QL	<QL	1	<QL	<QL	1	9.1	7.9	8.4
10-May-15	<QL	<QL	1	<QL	0.82	1	7.8	7.6	8.3
10-Jun-15	<QL	<QL	1	<QL	<QL	1	7.4	6.5	8.7
10-Jul-15	<QL	1.2	2	<QL	<QL	1	6.6	7.3	8.4
Permit Limit	9.0	11	20	0.54	3.00	126	6.5	6.0	9.0
AVERAGE	N/A	2.17	1.08	0.25	0.78	1.03	8.19	7.7	8.56
Percentage of Limit	N/A	19.72	5.42	46.30	26.13	0.82	N/A	N/A	N/A
Baseline Monitoring Freq.	1 per Month	1 per Month	1 per Week	1 per Month	1 per Month	1 per Week	1 per Day	1 per Day	
2015 Proposed Freq.	1 per Month^	1 per Month"	1 per Week°	1 per 3 Months*	1 per 3 Months	1 per Week°	1 per Day~	1 per Day**	

^ cBOD5 monitoring frequency will remain at 1 per Month based on PWJ as cBOD is an operational parameter.

" Per GM14-2003, TSS monitoring frequency should remain at 1 per Month unless limit is required for water quality related reasons.

° Monitoring frequency reduction not applicable for Bacteria as the facility uses alternate disinfection methods (UV light) and the discharge occurs in shellfish waters (per GM14-2003).

* Based on performance, Ammonia monitoring frequency would be eligible to a reduction of 1 per 6 Months when a permit limit of 1.67 mg/L is used. However, because the final limitation for this parameter in the 2012 Permit is 0.54 mg/L, a frequency of 1 per 3 Months is assigned based on PWJ (percentage of Permit Limit = 46.30).

** Reduced monitoring for pH considered on a case by case basis. Per GM14-2003, reduced monitoring of pH is not granted when the minimum or maximum pH values fall within 0.5 of the minimum or maximum limitations.

~ In accordance with GM14-2003, reduced monitoring frequency for DO not applicable as DO values fell within 0.5 of the permit limit over the last three years

Attachment J: Permit Revocation and Reissuance in Lieu of Modification Correspondence

HRSD
Cleaning wastewater every day for a better Bay.

May 28, 2015

Laura Galli
Dept of Environmental Quality
4949-A Cox Road
Glen Allen, VA 23060

RE: Central Middlesex STP VA0073318 Revoke and Reissue

Dear Ms. Galli,

Hampton Roads Sanitation District (HRSD) submitted the results of a Water Effects Ratio (WER) study for copper to DEQ in December 2013. The study was approved in November 2014 and DEQ-Central Office stated that a factor of 28.68 could be used to multiply the Virginia copper criteria for the Central Middlesex STP. The copper limit proposed in the VPDES permit issued in 2012 is not yet effective which allows opportunity to re-evaluate the need for a limit. HRSD has been monitoring copper on a monthly basis and submitting the results to your office on the Discharge Monitoring Report. Based on the copper data and the approved WER of 28.68, there is no reasonable potential for exceedance of the Water Quality Standard.

The proposed monthly and weekly ammonia limits have also not yet become effective. HRSD submitted correspondence regarding our position on the implementation of a weekly limit to your office. We are awaiting DEQ's response in consideration of our comments.

Since the VPDES permit is due to expire in approximately eighteen months, HRSD is requesting that the permit be revoked and reissued rather than modified to address the final effluent limitations. A signed form for this request is attached to this correspondence along with a permit application package.

Please contact me if you have any questions.

Sincerely,

Jamie Heisig-Mitchell
Chief of Technical Services Division

Enclosures

Permit Revocation Agreement Form for Revocation and Reissuance

SUBJECT: Revocation and Reissuance of VPDES Permit No. VA0073318

TO: Department of Environmental Quality-Piedmont Regional Office
4949-A Cox Road
Glen Allen, VA 23060

FACILITY: Central Middlesex STP

FROM: Hampton Roads Sanitation District
1434 Air Rail Avenue
Virginia Beach, VA 23455

I hereby agree to the revocation of VPDES Permit No. VA0073318 and waive my right to a hearing in accordance with the State Water Control Law. This agreement is made with the understanding that concurrent with this revocation, a new VPDES permit will be reissued for the appropriate discharge(s) previously permitted under VPDES Permit No. VA0073318.

SIGNED: _____

PRINT NAME: Edward G. Henifin, P.E

TITLE: General Manager

DATE: May 28, 2015

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
PIEDMONT REGIONAL OFFICE
4949-A Cox Road, Glen Allen, Virginia 23060
(804) 527-5020 Fax (804) 527-5106
www.deq.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

Michael P. Murphy
Regional Director

June 3, 2015

Mr. Ted Henifin,
General Manager
Hampton Roads Sanitation District
P.O. Box 5911
Virginia Beach, VA 23471-0911

Transmitted via Electronic Mail to: thenifin@hrsd.com

RE: Request for Modification of VPDES Permit No. VA0073318

Dear Mr. Henifin:

The Virginia Department of Environmental Quality has received your request for permit modification. Rather than modifying and subsequently reissuing the permit, we request that you consider revocation and reissuance of your permit. By pursuing this course, you and the staff can avoid the time consuming duplication of paperwork and the expense of a public notice publication for an additional permit action. This permit action can incorporate the changes you proposed in your modification request and others which may be required by the Clean Water Act and State Water Control Law. In addition, the life of the permit will be extended for five more years.

In order to reissue your permit it is first necessary to revoke the current permit. If you agree with the proposed revocation and reissuance and wish the prescribed hearing to be dispensed with, please sign and date the attached agreement form in the spaces provided and return it to this office.

The instructions and application forms are available at: http://www.deq.virginia.gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination/PermitsFees.aspx#GGPs under the heading of Individual Application Forms. Please submit the following forms:

- EPA Form 1 (including topographic map as required in section XI)
- EPA Form 2A
- VPDES Permit Application Addendum
- DEQ Sewage Sludge Permit Application

Please note that any sections of the application that are not applicable to your activity should be marked "N/A." Blanks in the application may result in the application being deemed incomplete.

There is no application fee for a regularly scheduled reissuance of an individual permit; that fee has been replaced by an annual permit maintenance fee which is to be paid by October 1 of each year. No permit will be reissued unless all maintenance fee payments are up to date.

If you have any questions, please contact me at 804-527-5095 or laura.galli@deq.virginia.gov.

Sincerely,

Laura Galli
VPDES Permit Writer

Enclosures:
Permit Revocation Agreement Form for Revocation and Reissuance
VPDES Permit Application Addendum
Paperwork Reduction Act notice
List of Common Application Errors
Pollution Prevention Flyer

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
PIEDMONT REGIONAL OFFICE
4949A Cox Road, Glen Allen, Virginia 23060
(804) 527-5020 Fax (804) 527-5106
www.deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

Michael P. Murphy
Regional Director

June 3, 2015

Mr. Ted Henifin
General Manager
Hampton Roads Sanitation District
P.O. Box 5911
Virginia Beach, VA 23471-0911

Transmitted via Electronic Mail to: thenifin@hrsd.com

Re: VPDES Permit No. VA0073318**,** Central Middlesex STP – Permit Modification Request

Dear Mr. Henifin:

The Virginia DEQ has reviewed the permit modification request submitted by HRSD for the Central Middlesex STP received on February 21, 2012. Please find below the items requested for modification and DEQ's response to review of the requests:

1. Facility Permitted Design Capacity
   During the processing of the permit that became effective on January 12, 2012, some questions arose regarding the design capacity of the treatment plant. Previous modeling efforts established conventional permit limitations based on a design flow proposal of 0.0395 MGD in 1995 that was never built. HRSD and DEQ staff believes the correct design capacity of the existing plant to be 0.025 MGD. In order to ensure that the 1995 conventional permit limitations for a 0.0395 MGD plant are protective of water quality at 0.025 MGD design flow, DEQ Senior Planning Staff conducted a modeling effort using the same input variables and assumptions used in the 1995 model. As a result, the analysis indicated that limitations of 12 mg/l for $cBOD_5$ and 5.0 mg/l for dissolved oxygen were protective of in-stream criteria using the 1995 modeling assumptions. These limitations are less stringent than the historical limitations of 11 mg/L of $cBOD_5$ and 6.5 mg/L DO.

   HRSD has conducted a capacity analysis of the facility by applying the standards of the Sewage Collection and Treatment Regulations and concluded that the facility has a 0.025 MGD capacity. HRSD has requested a permit modification to incorporate the $cBOD_5$ and DO limitations that were developed using the in-stream sanitation analyses for a 0.025 MGD facility. Upon confirmation that the STP is a 0.025 MGD plant and request for permit modification, DEQ Senior Planning Staff performed model update analysis using current modeling protocols and assumptions. Based on an updated modeling effort, the permit limitations to be applied for the 0.025 MGD plant are as follows: $cBOD_5$ = 9.0 mg/L, TKN, 3.0 mg/L and DO =6.3 mg/L.

2. Ammonia Limitation
   HRSD requested that DEQ remove the weekly ammonia limitation in the VPDES permit for the subject facility effective January 12, 2012 stating that the imposition of a weekly ammonia limitation to protect against chronic toxicity is in opposition of the Virginia Water Quality Standards (9VAC 260 et.seq.) and EPA's chronic water quality criterion for ammonia. The DEQ-Piedmont Regional Office has reviewed the request and consulted with the DEQ Office of VPDES Permits and has concluded that the weekly ammonia limitation has been appropriately applied. The weekly ammonia limitation was developed and included in the permit in accordance with Virginia DEQ water permitting guidance, the VPDES Regulation and Guidance on Preparing VPDES Permit Limitations (GM00-2011). 9 VAC 25-31-230.D.2 of the VPDES Permit Regulation requires that effluent limitations for continuous discharges from POTWs be expressed as weekly and monthly averages unless impracticable. This provision mirrors the federal requirements found in 40 CFR 122.45(d)(2). There is no requirement that the monitoring term of the effluent limitation match the duration of the water quality criterion and the above referenced requirements mean that DEQ routinely uses weekly and monthly average effluent limitations to ensure compliance with hourly average, daily average, 4-day average and 30-day average water quality criteria. For effluent limitations intended to protect toxicity-based water quality criteria, DEQ relies on the statistical approaches included in EPA's Technical Support Document for Water Quality-based Toxics Control which are appropriate for exposure periods up to 30 days. This approach accounts for effluent variability and the number of samples taken to develop weekly average and monthly average limitations that are both representative of the same long term average data distribution necessary to maintain the water quality criterion.

   Based on these findings, the removal of the weekly limitations is not appropriate because it would result in a permit that is not in compliance with the regulations promulgated under the Clean Water Act or the Virginia State Water Control Law.

3. Water Effect Ratio Study
   HRSD submitted a Water Effect Ratio (WER) study for copper on December 18, 2013 to be reviewed and approved by DEQ Central Office. The study was approved by DEQ CO on November 6, 2014.

During a phone call on May 8, 2015, DEQ and the permittee discussed an agency initiated Revoke and Reissue option in lieu of a permit modification. If the permittee agrees to the Revoke and Reissue option, the modification request (to include more stringent $cBOD_5$ and DO limitations based on the confirmed design flow, and the WER study results) will be processed during reissuance. A separate Reissuance in Lieu of Modification letter will be sent to the permittee.

Should you have any questions regarding this letter, please contact me at 804-527-5095 or laura.galli@deq.virginia.gov.

Sincerely,

Laura Galli
VPDES Permit Writer

cc: Sharon Nicklas, HRSD Permits Manager (electronic)
Jamie Mitchell, HRDS Chief of Technical Services

HRSD
Cleaning wastewater every day for a better Bay.

February 16, 2012

CERTIFIED MAIL
RETURN RECEIPT

Jaime Bauer
Dept of Environmental Quality
4949-A Cox Road
Glen Allen, VA 23060

RE: Central Middlesex STP VA0073318
Request for Permit Modification

Dear Ms. Bauer:

Hampton Roads Sanitation District (HRSD) requests a modification of the Central Middlesex STP VPDES permit. This request is precipitated by the following two issues affecting the permit limitations.

Facility Permitted Design Capacity

The Fact Sheet states that there is uncertainty regarding the design capacity of the Central Middlesex STP. The plant underwent an expansion project in the early 1990's when the regional security center owned the facility. In 2010, the VPDES permit was transferred to HRSD ownership. DEQ and HRSD conducted a file search and were unable to produce suitable documentation of the plant's design capacity. Attachment 6 of the fact sheet states that the modeling which generated the current monthly $cBOD_5$ limit of 11 mg/l and dissolved oxygen limit of 6.5 mg/l was based on a plant discharge flow of 0.0395 MGD. The plant's owners at the time were anticipating a capacity of 0.0395 MGD due to planned plant modifications. However, there is no record of a CTO being issued for a capacity of 0.0395 MGD. Therefore, HRSD has conducted a capacity analysis of the facility by applying the standards of the Sewage Collection and Treatment Regulations. The analysis has concluded that the facility has a 0.025 MGD capacity. A copy of the analysis and an application for the Certificate to Operate (CTO) the 0.025 MGD facility is enclosed in this correspondence. Upon issuance of this CTO, HRSD requests that the permit be modified to incorporate the $cBOD_5$ and dissolved oxygen (DO) limitations that were developed using the instream sanitation analyses for a 0.025 MGD facility. The VPDES regulations (9VAC25-31-220.L.2.b.(1)) allow a permit to be reissued with a less stringent effluent limitation if, "Information is available which was not available at the time of permit issuance (other than revised regulations, guidance, or test methods) and which would have justified the application of a less stringent effluent limitation at the time of the permit issuance." During the last permit reissuance, DEQ used the stream sanitation analytical model at a flow of 0.025 MGD to evaluate the facility limitations, calculating protective instream criteria of 12 mg/l for $cBOD_5$ and 5.0 mg/l for dissolved oxygen. The antibacksliding regulation allows for limit

Water Quality Department • PO Box 5911, Virginia Beach, VA 23471-0911 • 757.460.7004 • Fax 757.318.6452

modification if information becomes available which justifies the issuance of less stringent limits. Since information has been produced which identifies the definitive capacity of this facility, HRSD requests that the results of the DEQ model applicable to this capacity be implemented.

Ammonia Limitation

DEQ-PRO has included monthly and weekly limits to address the potential for chronic ammonia toxicity. The imposition of a weekly limit to protect against chronic ammonia toxicity is in opposition to Virginia regulations (9VAC 25-260, January 2011) and EPA's chronic water quality criterion for ammonia. The chronic ammonia standard in Virginia regulations (consistent with the EPA criterion) is expressed as a 30-day average. Chronic toxicity is observed only after an extended duration of exposure. In fact, chronic effect concentrations can be exceeded for a relatively short period of time with no adverse effect on the aquatic environment. The application of a standard that is meant to represent a 30-day average as a weekly limit contradicts the science used to develop the chronic criteria. A single excursion of a chronic ammonia limit in a 7-day time frame will not cause an impact in the aquatic environment provided the acute wasteload allocation is not exceeded for the duration of the applicable acute ammonia standard (refer to the 1985 Technical Support Document for Water Quality Based Toxics Control, EPA 440/4 85 032 for further discussion on duration and frequency as applied to the control of toxic pollutants). Use of the chronic limit with a weekly duration is not technically or scientifically defensible; therefore it cannot be used in a VPDES permit this way.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Copies of the permit application fee form and the payment are enclosed.

Sincerely,

Edward G. Henifin, P.E.
General Manager

Enclosures

Central Middlesex STP VA0073318

Design Capacity Evaluation per SCAT Regulations

SCAT Regulation	Parameters	Value	Condition at Design Flow Rate	Condition at Peak Hourly Flow Rate
9 VAC 25-790-690. Suspended Growth Process				
The size of the aeration basin for any particular adaptation of the process shall be based on such factors as (i) the design flow; (ii) degree of treatment desired; (iii) sludge age (MCRT); (iv) MLSS concentration; (v) BOD_5 loading; and (vi) F/M ratio.	Aeration Tank Volume	35,300 gals		
	Operating MLSS	6000 mg/l		
	Influent BOD conc.	174 mg/l		
	Design Flow Rate	0.025 MGD		
Process Detention Time = 24 hrs	Detention time at 0.025 MGD		33.8 hrs	
F/M Ratio = 0.05 - 0.2	F/M Ratio at 0.025 MGD		0.026	
Reactor Loading = 10 - 15 #BOD/1000 ft^3/day	Reactor Loading at 0.025 MGD		7.7 #BOD/1000 ft^3/day	
9 VAC 25-790-530. Secondary Clarifiers				
	Clarifier Surface Area	200 ft^2		
	Clarifier Weir Length	21.4 ft		
	Design Flow Rate	0.025 MGD		
	Peak Hourly Flow Rate	0.050 MGD		
	Recycle Flow Rate (Fixed)	0.0725 MGD		
	Operating MLSS	6000 mg/l		
The peak hour surface settling (overflow) rates for sewage treatment works with an average design flow of 0.1 MGD or less shall not exceed 800 gal/day/ft^2	Peak Hour Surface Settling Rate			250 gpd/ft^2
...weir loading rates should not exceed 10,000 gallons per day per linear foot for treatment works designed for average flows of 1.0 MGD or less.	Weir Loading Rate		1168 gpd/lf	2336 gpd/lf

Central Middlesex STP VA0073318
Design Capacity Evaluation per SCAT Regulations

SCAT Regulation	Parameters	Value	Condition at Design Flow Rate	Condition at Peak Hourly Flow Rate
9 VAC 25-790-530. Secondary Clarifiers (Continued)				
The solids loading shall be evaluated at both the peak hourly and average daily flow conditions in the design of secondary clarifiers, for comparison to the hydraulic loading. (From the table for extended aeration: 0.2 - 1.0 #/ft^2/hr @ average daily flow, 1.4 #/ft^2/hr @ peak hourly flow)	Solids Loading Rate		1.0 #/ft^2/hr	1.3 #/ft^2/hr
9VAC25-790-860 Filtration				
	Effluent Filter Surface Area	28 ft^2		
	Peak Hourly Flow rate	0.050 MGD		
General design. Conventional effluent filtration shall be accomplished at a uniform rate of one to five gallons per minute per square foot of surface area through the media consisting of a specified depth of the following materials, either as a single media, or an approved combination of multiple layers...	Peak Hour Surface Loading Rate			1.2 gpm/ft^2

Department of Environmental Quality
APPLICATION for CERTIFICATE TO OPERATE
Under the Sewage Collection and Treatment Regulations 9 VAC 25-790
and/or the Water Reclamation and Reuse Regulation 9 VAC 25-740

See instructions. Submit 1 copy of this form and any attachments. Form will expand as you enter information.

Project Title: (as it appears on plans) Central Middlesex STP VA0073318 Design Capacity Analysis P.E. Seal Date on Cover: N/A Specifications Title and Date: N/A	
Location of Project:170 Oak Landing Road	County/City: Middlesex/Saluda
Receiving Wastewater Collection System(s): Middle Peninsula Regional Security Center	
Receiving Sewage Treatment Plant(s): Central Middlesex STP	
PROJECT OWNER: HRSD	**RESPONSIBLE ENGINEER**
Owner Contact Name: G. David Waltrip	Name: G. David Waltrip
Title: Director of Operations	Company Name: HRSD
Address: 1436 Air Rail Avenue Virginia Beach, VA 23455	Address: 1436 Air Rail Avenue Virginia Beach, VA 23455
Phone: 757-460-4223	Phone: 757-460-4223
Email: dwaltrip@hrsd.com	Email: dwaltrip@hrsd.com
Owner Signature and Date: G David Waltrip 2/10/2012	

PTL NUMBER FROM CERTIFICATE TO CONSTRUCT: N/A

Attach Copy of the original Certificate to Construct if issued prior to November 9, 2008. If applicable, provide verification of compliance with any conditions in the Certificate to Construct.

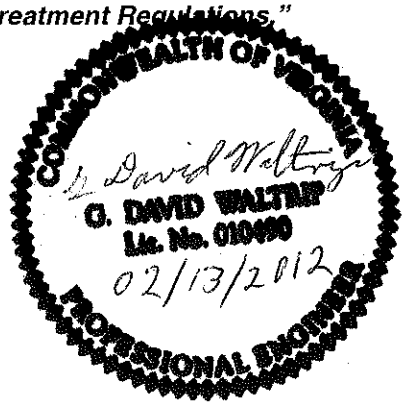
Design Flow: (a) average daily flow (MGD): 0.025 (b) peak flow (MGD): 0.050
For sewage treatment plant, water reclamation or satellite reclamation projects, provide the VPDES/VPA Permit Number: VA0073318
Is a new Discharge Monitoring Report (DMR) or other monthly monitoring report required? Yes ☐ No ☒
For Pump Stations, Sewage Treatment Plants, and Reclamation Systems, check Reliability Class: I ☒ II ☐ III ☐ NA ☐

.....

Two options are provided for the Statement of Completion, depending on whether the project is being authorized under the Sewage Collection and Treatment Regulations, the Water Reclamation and Reuse Regulations, or BOTH. Please check the appropriate box and then provide signature and seal below as indicated.

☒ *The following statement of completion for issuance of a Certificate to Operate under the Sewage Collection and Treatment Regulations must be signed and sealed by the responsible engineer.* (DEQ will not conduct a confirming inspection.)

"The construction of the project has been completed in accordance with the referenced plans and specifications or revised only in accordance with 9 VAC 25-790-180.B, and inspections have been performed to make this statement in accordance with Section 9 VAC 25-790-180.C.1 of the Sewage Collection and Treatment Regulations."



Licensed Engineer's Signature and original seal (signed and dated)

☐ *The following statement of completion for issuance of a Certificate to Operate under the Water Reclamation and Reuse Regulation must be signed and sealed by the responsible engineer.* (DEQ will not conduct a confirming inspection.)

"The construction of the project has been completed in accordance with the referenced plans and specifications or revised only in accordance with 9 VAC 25-740-120-B.2.b. and inspections have been performed to make this statement in accordance with Section 9 VAC 25-40-120.B.3.a. of the Water Reclamation and Reuse Regulations."

Licensed Engineer's Signature and original seal (signed and dated)

.....

For DEQ use only:

In accordance with *Code of Virginia* 1950, as amended, Title 62.1, Section 62.1-44.19, this form, signed by the appropriate DEQ representative, serves as the **Certificate to Operate** for the referenced project.

Name	Signature	Date	CTO PTL Number

Department of Environmental Quality Authorized Representative

An Operation and Maintenance Manual must be submitted to the DEQ Regional Office in accordance with 9 VAC 25-790 for sewage treatment plants, 9 VAC 25-740 for water reclamation systems and satellite reclamation systems and VPDES or VPA permit requirements.

For pump stations, an Operation and Maintenance Manual must be maintained for the facility in accordance with 9 VAC 25-790, but is NOT to be submitted to DEQ. The pump station must be operated and maintained in accordance with that manual.

Attachment K: Exceedance of 95% Design Capacity Correspondence

HRSD
Cleaning wastewater every day for a better Bay.

September 11, 2014

Laura Galli
Department of Environmental Quality
4949-A Cox Road
Glen Allen, VA 23060

RE: Central Middlesex STP VA0073318
95% of Design flow

Dear Ms. Galli:

The Central Middlesex STP reported monthly flows averaging greater than 95% of its design capacity for the months of June, July and August 2014.

Despite the elevated flows, Central Middlesex reported compliance with all VPDES permit requirements. The plant expects the flow will remain at this level. Due to its domestic characteristics, the plant does not anticipate any problems handling this flow in the future.

HRSD has implemented a plan of action as directed by Part I C.1. of the VPDES permit. HRSD's Commission approved a professional services agreement with Draper Aden Associates for the Urbanna and Central Middlesex Treatment Plants Replacement and Expansion and Central Middlesex Collection System Expansion. The project will replace the existing Urbanna and Central Middlesex STPs with one regional treatment facility. Flow projections will be developed in conjunction with county planning to allow for future expansions of the new treatment plant and collection systems in the Urbanna and Saluda areas. The project is listed as MP-111 of the HRSD Capital Improvement Plan.

Please contact my office if you have any questions or desire further information.

Sincerely,

James J. Pletl, Ph.D.
Director of Water Quality

HRSD
Cleaning wastewater every day for a better Bay.

March 10, 2014

Emilee Adamson
Department of Environmental Quality
4949-A Cox Road
Glen Allen, VA 23060

RE: Central Middlesex STP VA0073318
95% of Design flow

Dear Ms. Adamson:

The Central Middlesex STP reported monthly flows averaging greater than 95% of its design capacity for the months of December 2013, January and February 2014. These elevated flow rates were caused by HRSD accepting flow from the Middlesex Courthouse and Sheriff's Department.

Despite the elevated flows, Central Middlesex reported compliance with all VPDES permit requirements. The plant expects the flow will remain at this level. Due to its domestic characteristics, the plant does not anticipate any problems handling this flow in the future.

HRSD has implemented a plan of action as directed by Part I C.1. of the VPDES permit. HRSD's Commission approved a professional services agreement with Draper Aden Associates for the Urbanna and Central Middlesex Treatment Plants Replacement and Expansion and Central Middlesex Collection System Expansion. The project will replace the existing Urbanna and Central Middlesex STPs with one regional treatment facility. Flow projections will be developed in conjunction with county planning to allow for future expansions of the new treatment plant and collection systems in the Urbanna and Saluda areas. The project is listed as MP-111 of the HRSD Capital Improvement Plan.

Please contact my office if you have any questions or desire further information.

Sincerely,

James J. Pletl, Ph.D.
Director of Water Quality

Attachment L: VDH and DSS Coordination Response

COMMONWEALTH of VIRGINIA

Marissa J. Levine, MD, MPH, FAAFP
State Health Commissioner

John J. Aulbach II, PE
Director, Office of Drinking Water

DEPARTMENT OF HEALTH
OFFICE OF DRINKING WATER
Southeast Virginia Field Office

830 Southampton Avenue
Suite 2058
Norfolk, VA 23510
Phone (757) 683-2000
Fax (757) 683-2007

Processing Office:
East Central Support Office
300 Turner Road
Richmond, VA 23225
Phone: (804) 674-2880

DATE: July 13, 2015

FROM: MS for Daniel B. Horne, PE, Engineering Field Director
Southeast Virginia Field Office

TO: Laura Galli, VPDES Permit Writer
DEQ Piedmont Regional Office
4949 A Cox Road
Glen Allen, Virginia 23060

CITY/COUNTY: Middlesex County

APPLICANT: Central Middlesex STP

PERMIT TYPE: VPDES

APPLICATION TYPE: Re-Issuance

PROJECT: Revoke and reissue VPDES Permit No. VA0073318

SUBJECT: Review response for DEQ's permit application VA0073318

Our Office has reviewed the application to revoke and reissue VPDES Permit No. VA0073318 for discharge of treated effluent from the Central Middlesex STP located on site in Saluda, Middlesex County.

No public raw water intakes were found, in the Commonwealth, downstream or upstream from the discharge point.

The following waterworks have wells within a 1-mile radius from the discharge zone: Aqua Virginia, Saluda waterworks.

There are no apparent impacts to waterworks sources as a result of this permit.

cc: VDH, ODW – Central Office
VDH, Middlesex County Health Dept.
ANM Jamie Heisig-Mitcell, Chief of Technical Services Division, HRSD

r:\ecso-serverdata\district\pd18\05-project review\01-application-deq\vpdes\application\central middlesex stp (saluda jail).docx

Archived: Tuesday, September 22, 2015 1:30:00 PM
Importance: Low

Laura,

It doesn't look like there are any changes in the flow, disinfection type or outfall location. If those are correct, DSS would not have an comments on the reissuance. Let me know if you have any questions or need anything else.

Thanks,

Keith

From: Galli, Laura (DEQ)
Sent: Thursday, September 03, 2015 3:54 PM
To: Skiles, Keith (VDH)
Subject: VA0073318 Revocation and Reissuance VDH DSS Coordination

Mr. Skiles,

Please see attached the coordination letter for the revocation and reissuance of Central Middlesex STP, VPDES No. VA0073318.

Should you have any questions, please let me know.

Regards,

Laura

Attachment M: Owner Comments and DEQ Response to Comments

Archived: Tuesday, December 29, 2015 3:12:32 PM
Importance: Low

Jamie,

Thank you for expressing your concerns on the TKN limitation of 3 mg/L. The permit fact sheet already explains the rationale behind this limitation. This limitation is necessary to meet the dissolved oxygen water quality standard instream, and is required by the March 2012 Stream Sanitation Analysis. The ammonia limitation is calculated separately to protect toxicity for aquatic life, and is not intended to meet the DO WQS.

Please let me know if you have remaining concerns on this.

Thanks,

Laura

Laura Galli

VPDES Permit Writer

Virginia Department of Environmental Quality

Piedmont Regional Office

4949-A Cox Rd

Glen Allen, Virginia 23060

Ph. (804) 527-5095

laura.galli@deq.virginia.gov

From: Mitchell, Jamie [mailto:JMITCHELL@HRSD.COM]
Sent: Wednesday, November 18, 2015 3:49 PM
To: Galli, Laura (DEQ)
Cc: Grimmer, Lauren

HRSD
Cleaning wastewater every day for a better Bay.

Delivered via email to Laura.Galli@deq.virginia.gov

November 19, 2015

Laura Galli
Dept of Environmental Quality
4949-A Cox Road
Glen Allen, VA 23060

RE: Central Middlesex STP VA 0073318

Dear Ms. Galli:

Hampton Roads Sanitation District (HRSD) has reviewed the draft permit and fact sheet for the Central Middlesex STP and offers the following comments for DEQ consideration.

Part I. A., Limitations and Monitoring Requirements: HRSD does not agree with the need for a TKN limit in addition to an ammonia limit. DEQ indicates that ammonia is 40 - 60% of the TKN concentration, meaning that an ammonia limitation of 0.56 mg/L is protective of all TKN limits below 1.4 mg/L. VPDES Guidance GM00-2011 indicates that when evaluating the need for an ammonia or a TKN limitation, the "more stringent of the two should be placed in the permit". Given that an ammonia limit of 0.56 mg/L (roughly equivalent to no more than 1.4 mg/L of TKN) is more stringent than the 3.0 mg/L TKN required for swamp and marsh waters, a limitation for both is not needed. Ammonia concentrations less than 0.56 mg/L will not result in a TKN concentration greater than 3.0 mg/L.

Part I. A., Limitations and Monitoring Requirements: Recognizing that weekly and monthly average effluent limitations are required unless impracticable under regulation (9VAC 25-31-230.D.2), HRSD continues to assert that it is not technically defensible to express a chronic limitation for ammonia as a weekly average. Given the regulatory constraint which fails to recognize the unique 30-day chronic averaging period for ammonia in its requirement for a weekly/monthly expression of effluent limitations, HRSD agrees to proceed with the permit with its current expression of weekly/monthly averages.

Please contact me if you have any questions or would like to discuss HRSD's concerns.

Sincerely,

Jamie S. Heisig-Mitchell

Jamie S. Heisig-Mitchell
Chief of Technical Services Division